INTELLIGENT MARITIME

Modern Ships and Ports

Dell Technologies and Intel are committed to working with the industry to transform commercial shipping and shape the future of maritime innovation.

Sanjay Tyagi

VICE PRESIDENT & GENERAL MANAGER
DELL TECHNOLOGIES, OEM I EMBEDDED & EDGE SOLUTIONS

As global maritime trade increases, Dell Technologies and Intel are helping the industry move forward with the next wave of innovation, enabling ships and port operators to achieve their safety, security, and efficiency objectives.

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OVERVIEW

Humankind has traveled across rivers, lakes, seas, and oceans to reach "unpathed waters and undreamed shores" as Shakespeare wrote. From the simple wooden sail boats of Mesopotamia to the autonomous ships of tomorrow, it is second nature for humankind to make the most of the world's waterways to transport goods and people. The impact of our seafaring inclinations has changed the course of human history and will continue to do so in the future. Historically, people could travel more quickly via sea than land routes to explore and expand trade networks. Earliest clues of sailing vessels date back to 5000 BC, as a ship appears on a painted disc found in the Arabian peninsula.[1] Every maritime innovation—from the dugout canoe, to the catamaran, to longships and galleons and beyond—has helped us navigate our path toward modern times.

Looking to the future, we can't help but wonder what's next? Forward-thinking leaders in both maritime and information technology industries agree that ships and ports are on the cusp of a transformation which will introduce new opportunities to improve safety, productivity, security, and profitability with intelligent maritime solutions. Computing and supporting technology advancements represent the next step in the journey for the maritime industry.

This sea change comes at a moment when new ports are under construction and existing ports are undergoing renovation. The recent Panama Canal and Suez Canal expansions initiated a worldwide wave in port updates. Today, megaships carry more tonnage, cargo is more diverse, and much more of it is shipped throughout the world. Contractors are in high demand to help ports update infrastructure, add new rail connection lines, construct more storage facilities, enhance security, and improve the efficiencies of port operations. Meeting increasing demand for timely goods is a top priority for ports worldwide and billions will be spent to make them more competitive.[2] Safer, more efficient ports are being designed, built, and managed to use less space and resources, thereby reducing the environmental impact of operations. Maritime industry leaders have an unparalleled opportunity to incorporate new innovations into their infrastructure.

Envisioning the Intelligent Maritime Opportunity

We are at an inflection point in the Maritime industry where Shipping and Port Operators must seize the opportunity to rise with the tide or risk being left in the shallows. The maritime industry can transform by leveraging advances in information, communication, Internet of Things (IoT), Artificial Intelligence (AI), Machine Learning (ML), Edge to Cloud and now 5G, ultimately improving operations and the bottom line.
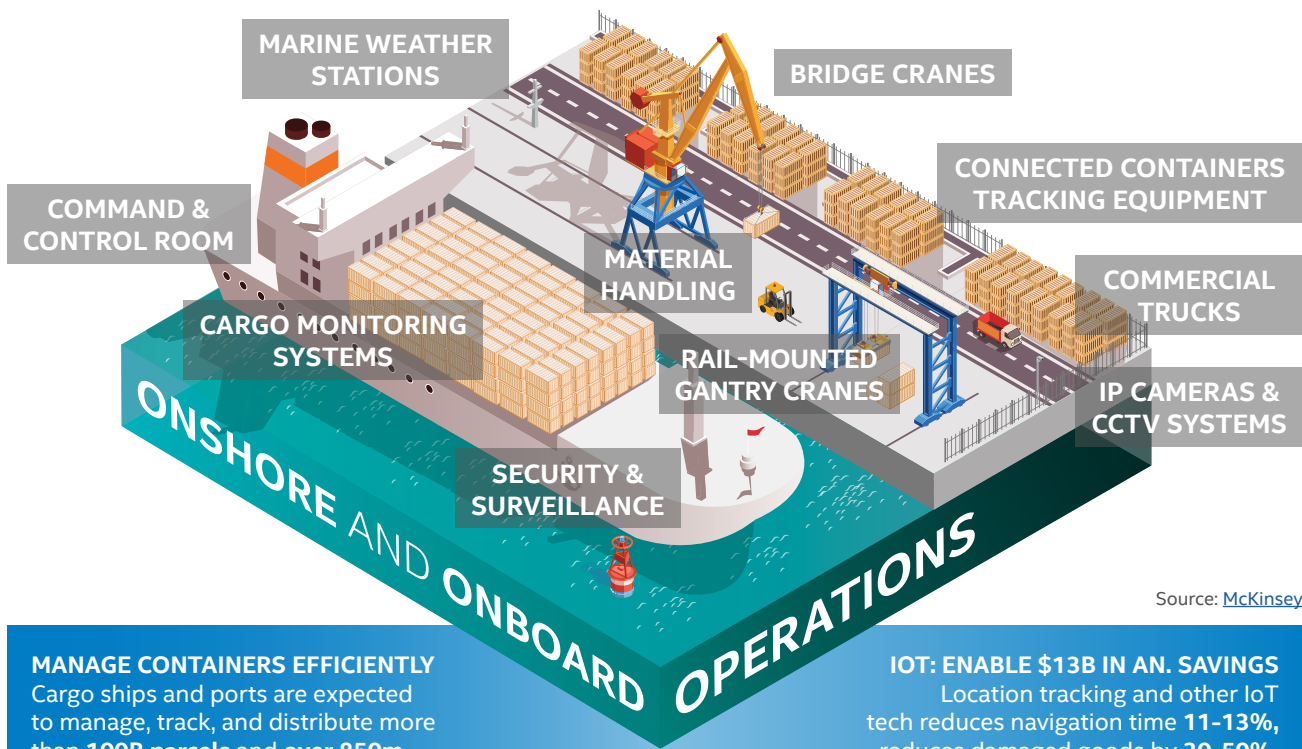
Given that the shipping and ports are already a data-rich environment, new transformative maritime technology can leverage this by orchestrating Information Technology (IT) and Operational Technology (OT) systems both landside and for the commercial operation of ships and fleets. By combining these new technologies to share data between the various stakeholders in ships and ports operations, the industry can realize a potential USD $13 Billion in annual savings.[3]

In fact, change is already underway, as a convergence between the physical and digital worlds builds. Disruptive innovation offers significant potential for operating in a new way at sea and in ports. On the next page, see a few examples of the positive changes intelligent maritime can enable.

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1 Antiquity, March 2006
2 ConstructConnect: U.S. Ports Will Launch Many New Projects in 2019. May 9, 2019.
3 McKinsey

MARINE WEATHER STATIONS

BRIDGE CRANES

COMMAND & CONTROL ROOM

CONNECTED CONTAINERS TRACKING EQUIPMENT

MATERIAL HANDLING

COMMERCIAL TRUCKS

CARGO MONITORING SYSTEMS

RAIL-MOUNTED GANTRY CRANES

IP CAMERAS & CCTV SYSTEMS

SECURITY & SURVEILLANCE

ONSHORE AND ONBOARD OPERATIONS

Source: McKinsey

MANAGE CONTAINERS EFFICIENTLY
Cargo ships and ports are expected to manage, track, and distribute more than **100B parcels** and **over 850m TEUs** in container volume by 2020

IOT: ENABLE $13B IN AN. SAVINGS
Location tracking and other IoT tech reduces navigation time **11-13%**, reduces damaged goods by **30-50%**, and increases container utilization by **10-25%**

Connectivity and interoperability with IoT

Ship-to-shore connectivity creates vast amounts of data that can be processed in real-time, allowing shipping managers to make data-driven decisions for operations optimization and crew safety. Interoperability of systems, once considered a dream, is now becoming reality. Communication between systems multiplies potential value, which means that interoperability plays a crucial role in creating significant economic impact. McKinsey reports that 40 percent of the potential value of the IoT can be created through the interoperability of systems. In US dollars, this number is more than 4 trillion per year in potential economic impact.[4]

Artificial Intelligence to enhance safety

It is estimated that somewhere between 75% to 96% of shipping accidents involve human error.[5] These accidents could be prevented, or at minimum have reduced impact through better use of data and analytics. Until recently, the shipping industry has produced vast amounts of untapped data. By applying AI to data at the Edge, shipping managers can gain real-time insights through predictive analysis and artificial intelligence. These insights can alert the crew to dangerous situations and equipment failures before they occur.

5G enhancing communications

Intelligent maritime leaders can expect 5G to usher in dramatic changes for maritime communications. Imagine leveraging low latency sensors at the Edge to reduce response time for search and rescue operations, or enhancing your monitoring through real-time information accessed through drones.

Ultimately, by updating infrastructure to include intelligent maritime technology, ship and port operators can orchestrate IT and OT systems to achieve critical safety and security objectives, while increasing revenue and enabling new business outcomes. These systems help maritime organizations address multiple facets of the business including compliance, IT complexity, user-friendliness, operational inefficiencies, and business intelligence.

4 McKinsey
5 Allianz Global Corporate & Specialty SEs

Intel and Dell Technologies have a combined portfolio of cutting-edge technologies and solutions that are at the forefront of intelligent maritime. With decades of experience delivering state of the art technology together, Intel and Dell Technologies power every area of intelligent, connected ships, ports, supply chain, and services—from the Edge, to the network, to the cloud, to insights. Intel, Dell Technologies, and a vast set of ecosystem partners are working together to create a more dynamic, extensible, and sustainable way for maritime leaders to innovate.

This booklet provides an overview for how maritime leaders can achieve improved business outcomes through data-driven smart technologies and develop intelligent maritime strategies, fusing solutions that help ship and port operators realize new revenue streams and reduce costs through holistic technology integration. With these advances, maritime leaders can take the tide and harness the next generation of maritime innovation.

The vast, global maritime industry is composed of several different segments. This e-book will explore the sectors highlighted in the chart below, as summarized in *The Dutch Maritime Cluster Monitor*[6]

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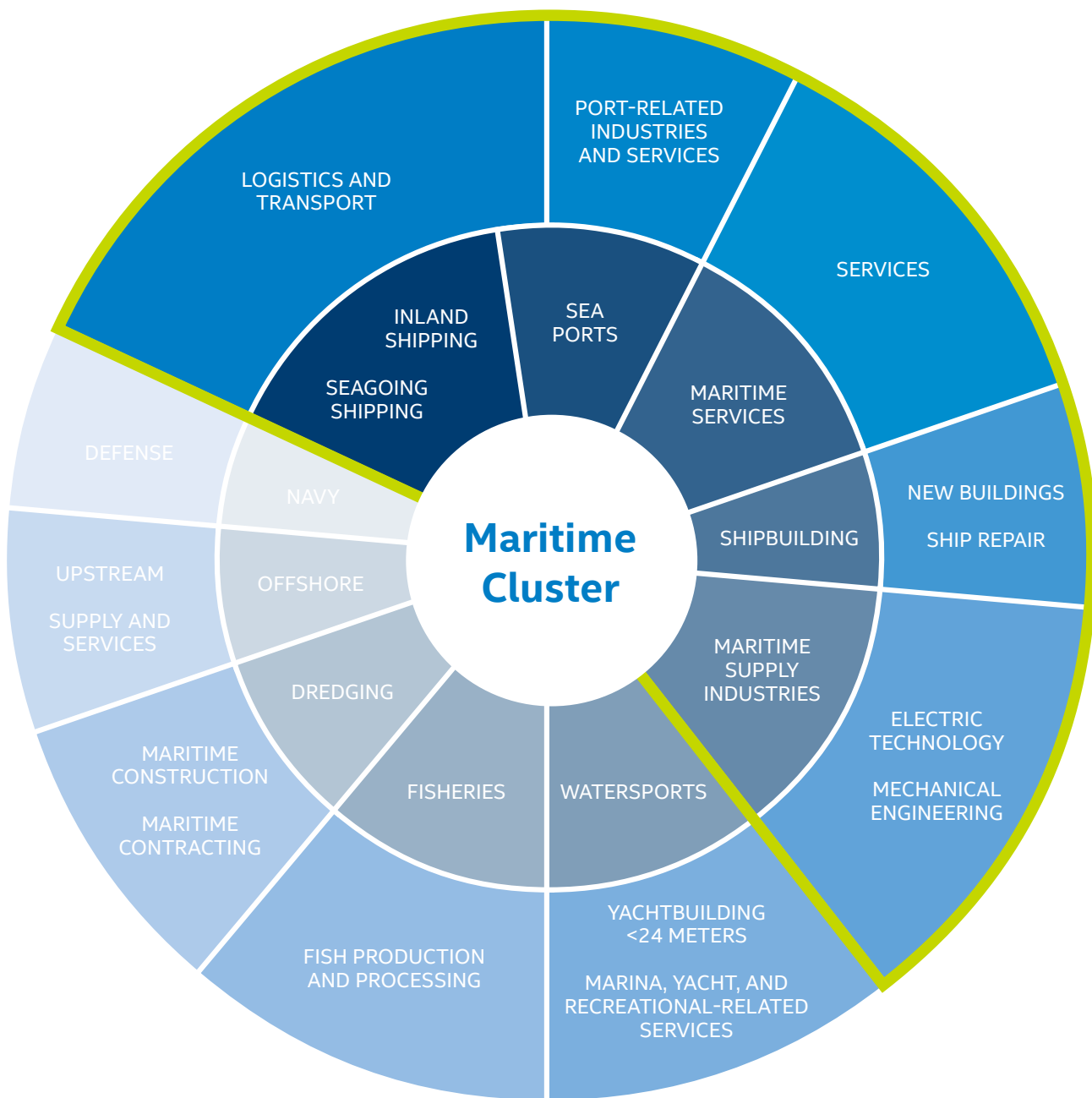
6 The Dutch Maritime Cluster Monitor

Benefits of Intelligent Maritime Solutions

Intelligent maritime describes the orchestration of technology across ships and ports, enabling ship and port operators to achieve critical safety, security, and efficiency objectives. As technology evolves for maritime operations, more data can be captured, analyzed, and acted upon to better optimize systems and enable new revenue opportunities and business outcomes.

Maritime leaders who implement intelligent maritime solutions will best meet growing demands for transporting goods, improving operational efficiency and achieving sustainability goals by using technologies such as sensor technology and the Edge, ubiquitous communication with 5G and satellite connectivity, big data analytics using open source software and cloud computing, and smart technologies including Machine Learning (ML), cognitive technologies, and autonomous systems.

1. Increase Productivity and Profitability

Edge computing helps users to process data generated by internet of things (IoT) devices rather than transmitting data across long distant data centers or cloud servers for processing. Ships, ports, and supply chain partners can combine data from various communications and systems to improve operations by collecting data and applying AI to monitor, manage and maintain human, mechanical, and technical assets and resources.

Ports

From a centralized, integrated control center, ports can use IoT devices to gather and analyze information that helps keep crew, cargo, and assets safe.

This technology also supports just-in-time maintenance for equipment and identifies opportunities to improve cargo handling operations. Measuring process time for each step of the docking and unloading process also delivers insights that can help streamline operations. Knowing the location of personnel by tracking stevedores (and other dockworkers) helps ensure productivity and safety while preventing non-authorized personnel (contingent workers, subcontractors) from entering sensitive areas.

Cargo Vessels

Onboard sensors can help ensure cargo and crew safety and efficiency by measuring and analyzing critical operational factors such as vibrations, temperatures, and wear in parts for just-in-time maintenance, ensuring smoother, more secure operations. This information helps container terminals optimize logistics by moving containers from point A (the feeder ship) to point B (the yard) to point C (the gate) efficiently, cost effectively, and quickly.

2. Improve Both Seaside and Landside Safety and Security

The safety of crew and dock workers is paramount, with similar importance given to port equipment, cargo vessels, supply chain partners, and the cargo itself.

Maritime organizations can use visual sensing technology with near real-time analytics capabilities to help make better on-the-spot or over-time strategic decisions about how to keep cargo, equipment, workers, and assets safe. Intelligent Transportation Systems (ITS) merge data from cameras and sensors to increase efficiency, safety, and security in real-time.

Ports

With near real-time visual sensing technology using analytics capabilities (smart video analytic solutions) ports can track assets, avoid congestion in cargo flow, and utilize warehouse space more efficiently. Thefts can be prevented or resolved more easily, and workers' and cargo' safety is better maintained. It is also easier to ensure vessel crews report for customs. Intelligent mooring with smart ropes can offer exact load information, in near real-time, helping to ensure mooring ropes have the right tension, in the right place, at the right time—and helping to prevent premature wear of ropes or unexpected rope failures.

Vessel license plate and facial recognition help enhance perimeter security and access control applications for ships and ports. These systems help monitor suspicious or anomalous behavior, improve access control, and match license plate data against watch lists. ANPR systems are most commonly installed at points of significant sensitivity, ingress or egress.

Cargo Vessels
Monitoring the safety of the crew, cargo, and vessel at sea and while docked is essential to any operation. In the event of abnormal activity such as sudden impacts, sensor alarms, or weather alerts, all critical data needs to be instantly streamed and made available to an operator. Ship and port operators require visibility into maritime operations and near real-time and historical insights into the use of their vessels and their operational environments.

Bulk Carriers
Bulk carriers are ships which transport cargoes in bulk quantities like food grains, ores, and coals and even cement. Liquefied cargo carried by bulk ship can include oil, petrol and various other liquid chemical substances. With enhanced monitoring capabilities, operators can achieve greater safety by enabling increased visibility into vessel operations, their cargo, and their environments on the sea or at port.
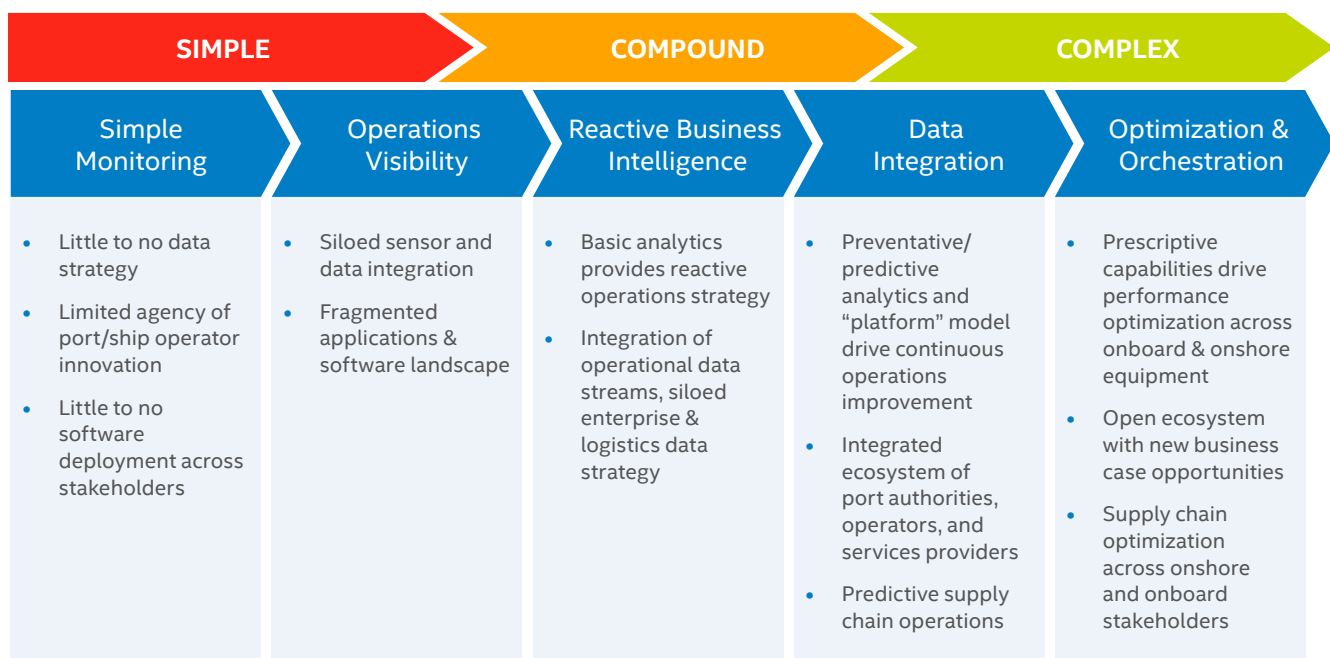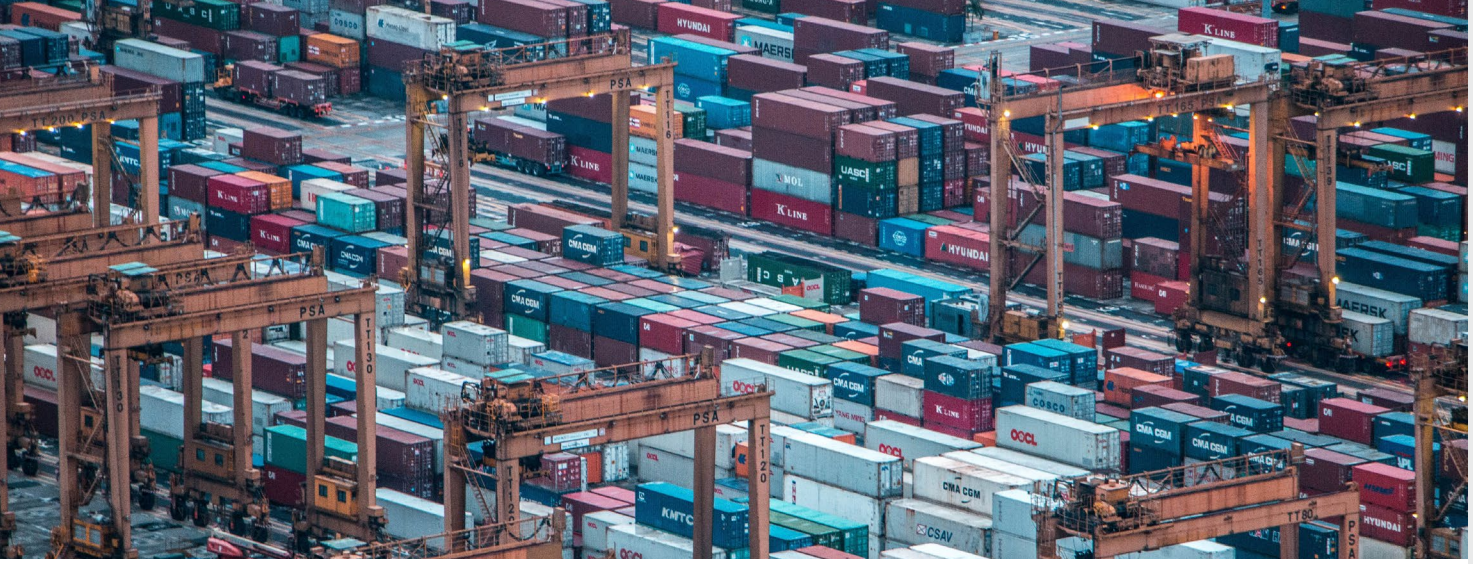
Roll-on/Roll-Off Carriers
Marine cargo handling personnel involved in roll-on roll-off (RO-RO) ship operations can increase safety by using enhanced monitoring capabilities to reduce hazards and prevent accidents, injuries, and fatalities when loading or unloading ships in port.

3. Ensure Reliability
By streamlining supply chain management, ports and shipping companies can more easily ensure that cargo is delivered safely, on-time, and with near real-time multi-party communication. Partners can select the most cost-effective sea and land transportation options and eliminate or decrease delays in transport and delivery of cargo. Because of more timely delivery of cargo, stock-outs or lost sales at the retail outlets on board can also be decreased. Supervisors can also be alerted to environmental changes (moisture, temperature, etc.) onboard which may endanger cargo or crew safety.

Application Evolution: Progressive Value

SIMPLE		COMPOUND		COMPLEX
Simple Monitoring	Operations Visibility	Reactive Business Intelligence	Data Integration	Optimization & Orchestration
• Little to no data strategy • Limited agency of port/ship operator innovation • Little to no software deployment across stakeholders	• Siloed sensor and data integration • Fragmented applications & software landscape	• Basic analytics provides reactive operations strategy • Integration of operational data streams, siloed enterprise & logistics data strategy	• Preventative/predictive analytics and "platform" model drive continuous operations improvement • Integrated ecosystem of port authorities, operators, and services providers • Predictive supply chain operations	• Prescriptive capabilities drive performance optimization across onboard & onshore equipment • Open ecosystem with new business case opportunities • Supply chain optimization across onshore and onboard stakeholders

INTERNATIONAL MARITIME ORGANIZATION

World Maritime Theme for 2020

Using intelligent maritime solutions will help to align your company with the maritime industry achieving the key goals of the World Maritime Organization, whose theme for 2020 is **Sustainable Maritime Operations for a Sustainable Planet.**

The International Maritime Organization (IMO) is the United Nations' specialized agency responsible for safety and security of ships and ports and the prevention of marine pollution by ships.

This theme supports United Nations' Sustainable Development Goals (SDGs) for 2030 which are a "universal call to action to end poverty, protect the planet, and improve the lives and prospects of everyone, everywhere."[7] Because of the significance of the transport sector, the elements of the 2030 Agenda can only be attained with a sustainable transport sector supporting world trade and facilitating a truly global economy.[8]

Goals

Marine Environment

Prevent pollution of the seas by ships, from seafarers to ship operators to port authority control officers.

Maritime Safety

Achieve compliance with international safety regulations and recommendations for ships and ports.

Maritime Security

Make trade and travel by sea as safe and secure as possible by more effectively managing and mitigating any threats with the potential to compromise maritime security.

Minimum Standards of Competence for Seafarers

International Maritime Organization (IMO) has established standards of Training, Certification, and Watchkeeping for Seafarers that takes into consideration the 'human factor' and recognizes that 90 percent of the world's trade relies on the competency and professionalism of seafarers. These codes were designed with the intention of improving the safety of international shipping and to reduce pollution.

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7 The Sustainable Development Agenda
8 International Maritime Organization

Nearly every consumer good bought today arrived at its destination by ship. Cargo ships have fueled, and perhaps even created, globalization. Envision how innovations in standards and technology can be combined to improve today's cargo ships for a better future.

Digital Twins

Optimized Cargo Handling and Logistics

THE CARGO SHIP OF 2025

Automated, Efficient Ship Operations

Connected Crew

Digital Twins

Digital twins are virtual representations of a ship and its operations, providing both remote (onshore) and onboard operators to have complete visibility of operations. This helps operators visualize and understand core ship operations (engine room, fire room, command and control) and enterprise functions (customs, tracking, quality management), by creating a digital map of operations, personnel, and enterprise objectives.

Optimized Cargo Handling and Logistics

AI, Computer Vision, and Blockchain technologies allow for operators to integrate various sensor and video data pulled from cargo monitoring and tracking devices and systems to optimize preservation, ensure visibility from origin to destination and automate customs processing.

Equipment automation improves cargo throughput, custom processing and ultimately expedites distribution and end-to-end supply chain efficiency. Automation and machine analytics also drive down costs associated with maintenance, performance inefficiencies and safety incidents.

Automated, Efficient Ship Operations

Advanced analytics and automation, entailing both navigation optimization and predictive maintenance applications, provide significant insight into ways to improve operations from mitigating risk and optimization routing and orchestrating maintenance services that occur at sea or in-port to avoid downtime. Furthermore, analytics and automation are foundational to improving ship operations to reduce fuel consumption – another cost savings and sustainable opportunity.

Connected Crew

Crew safety and wellness are critical for ship operators and until now, understanding the crew's physical position, activity and status while ensuring safe and efficient crew operations has been incredibly difficult. Wearable Technology and the integration of crew monitoring into broader ship operations and logistics not only improves the efficiency of workers but offers the ability to ensure safety by predicting or preventing hazardous situations.

Augmented reality (AR) provides virtual projections onto a technicians reality, improving the efficiency and precision of maintenance – enterprise AR is in the very nascent stages of development but is expected to improve not only the efficacy of maintenance operations, but enable risk assessment to improve safety and provide an immersive platform for training.

The Port of the Future

Taking advantage of transformative technologies in combination with careful planning can enable the Port of the Future to become a reality. Port automation is defined as complete integration of operational systems and disparate information across onshore, seaborn and landside distribution logistics. How these elements combine to improve port operations can be illustrated by four key areas.

Automated Throughput

In the future, shipping containers will be equipped with tracking devices that allow for complete operator visibility and tracking. Smart container technology with destination awareness will enable containers to be distributed via hyperloop at origin and destination ports.

Future port management solutions will allow for dynamic berthing scheduling. Real-time changes in ship arrivals and maintenance requirements will enable reduction in queue times as well as wasted berthing space at low-demand times.

Ubiquitous smart container technology, robotic distribution, holistic software solution, and hyperloop technology will enable streamlined, automated distribution that incorporates and provides feedback for real-time production and demand planning.

Robotic cranes and vehicles will help enhance the safety and efficiency of unloading, ship-to-shore transport, distribution, ship repair, cleaning, inspection, and maintenance. Cargo damage will be reduced through anti-sway transport. The autonomous terminal of the future will be run by operators with end-to-end visibility of port operations with complete control of these robots.

Looking forward, AR and VR technology will allow for more effective, affordable, safer simulation training of any human labor. Both operators and on-ground port staff will engage in scenario-based training remotely to assure preparedness for unforeseen circumstances and changes in port control procedures. This will minimize port incidents to streamline regulator inspection, lower insurance premiums, and reduce reputational risk for clients.

Interoperable port management software will enable stakeholders to have supply chain visibility and planning across ports.

> ### CUSTOMER SPOTLIGHT
> #### Ericsson Industry Connect
> Ericsson is using Intel and Dell Technologies solutions to create Ericsson Industry Connect, helping ports to address their connectivity challenges with a wireless connection that avoids expensive and time-consuming reconfiguring of environments for connected devices. The solution enables secure, reliable coverage with high device density and predictable latency enabling ports to become more autonomous and scale their assets at an increasing rate.
>
> **See Ericsson for more information.**

> ### CUSTOMER SPOTLIGHT
> #### Nokia Connected Ports
> Nokia is using Intel and Dell Technologies solutions to create a maritime industry platform for modernizing container terminal, port, and shipping operations. The platform helps ports take terminal operations into the digital age, build safer maritime facilities, improve onboard ship connectivity, and extend ship to shore.
>
> **See Nokia for more information.**

Centralized Operational Visibility

The autonomous port of the future will be run by operators using AI-enabled port management dashboards that provide end-to-end visibility and control of all port and container operations. A single pane of glass can illustrate visual sensing, resource utilization, terminal operations, and asset optimization, with complete integration across port, ship, and logistics technology.

The port of the future will incorporate a fleet of unmanned aerial vehicles (UAVs) and remotely piloted aircrafts (RPAs) for security patrolling, port infrastructure inspection, container transport, inventory measurement, incident detection, environmental monitoring and control, contamination detection, and mapping and surveying.

Smart grids and metering will improve resource efficiency in ports through a number of ways. Implementing these solutions will allow port operators to cut energy costs, reduce emissions, and simplify reporting and regulatory compliance.

AI-Enabled Security

The port of the future will have automated customs and container monitoring controlled by centralized port operators. By implementing machine vision and visual sensing technology for customs processing, port operators can increase efficiency, increase revenue generated via taxes and duties, and improve security.

Drone monitoring reduces labor costs, improves worker safety, and enhances security. Operators can pull radar, sensor, and drone sensor data to provide a holistic view into port security.

CUSTOMER SPOTLIGHT

Nokia Industrial-Grade Private Wireless for Ports

Nokia is using Intel and Dell Technologies solutions to help ports keep their operations running full speed ahead with reliable, dedicated, pervasive wireless that blankets the terminal, simplifies communications infrastructure and links containers, workers, and assets. State-of-the-art 4G wireless solutions anchor the evolution to 5G. With Nokia's high-speed, low-latency mobile broadband working for the entire port, operators can benefit from new levels of automation, safety, and control.

The solution helps ports to:

- Boost operational efficiency with improved cargo.

- Ensure dedicated IoT connectivity to support TOS data to cranes, vehicles and staff, smart devices, and more.

- Deploy robust, clear voice and group communications to keep everyone connected.

- Improve situational awareness and control in remote unmanned areas and manned areas to improve worker safety and wellness, workplace resource utilization, and speed response throughout the operation.

See Nokia for more information.

ADDRESSING COMMON CHALLENGES

In the midst of a changing seascape, today's maritime organizations are looking for new ways to control costs, ensure predictable and efficient operations, enhance compliance with international regulations and port state requirements, and improve crew safety.

Financial, regulatory, and societal pressures also continue to encourage ships and ports to lower their environmental impact. Ships are the most energy- efficient mode of transport, but there is still significant room for improvement regarding energy efficiency and associated emissions.

Digitalization is spurring automation to positively impact safety and environmental performance. Ships are becoming sophisticated sensor hubs and data generators, with advances in satellite communications improving ship connectivity. Onshore, new cloud technologies are dramatically impacting how vessels and their components are designed, built, and tested.[9]

The World Shipping Council reported that an average of 1,582 shipping containers were lost every year between 2008 and 2016. Some of these lost containers held cheap and harmless goods, but others concealed expensive and/or hazardous chemicals. We only know where a handful of these overboard containers are located, and hundreds more are lost on land each year.

PICKUP & DELIVERY TO PORT   BERTHING & MOORING   UNLOADING

TERMINAL EXIT

DISTRIBUTION PREPARATION   STORAGE   MATERIAL HANDLING

TERMINAL BERTH

DISTRIBUTION PROCESSING   WAREHOUSES

Supply Chain Logistics

A well-functioning supply chain means timely delivery to ports, protective warehousing, accident- and error-free loading onto vessels, safe and accurate navigation to a predetermined destination, offloading, and delivery on land to a distribution center. On top of these day-to-day basics, modern ships and ports and supply chain entities must also be able to operate at higher-than-ever capacity, under stricter environmental standards, and at greater profitability than ever before, while facing a complex set of factors and challenges that can impact business decision-making within the maritime environment.

Breakdowns in supply chain connection and communication during the long journey from source to destination can lead to the failure of any part of the supply chain and result in delays, lost cargo, and dissatisfied customers. Lack of connectivity between and among supply chain links means that difficult-to-detect, emerging problems may end up causing delays and impact everyone's bottom-line.

9 DNV GL: Shipping Technology Outlook, 2025. 2019.

Transportation is the lifeblood of the global economy as ships and ports serve as critical connection points to other transportation systems including planes, railways, commercial vehicles, buses, and cars. As the global population increases, the need for goods around the world increases commensurately across every mode of transport.

Climate Change

In the maritime industry, weather is king. As the climate changes, storm cycles are intensifying and shifting, which in turn will have impacts on available routes for vessels. In the coming decades these impacts are likely to accelerate and will need to be addressed globally every day.

The main impacts of weather on ships and ports include:

- Increased risk of injury to crew

- Increased risk of damage to cargo, vessels, and ports

- Interruption to supply chain based on cargo delivery delay

- Loss of toxic cargo which can damage the marine and landside environment

Environmental Impact

Waste from ships, toxic chemical and oil spills, and the environmental impact of dredging for the construction of new ports, all contribute to negative environmental impact.

The International Maritime Organization (IMO) imposed new low-sulfur fuel regulations to reduce childhood asthma and premature death and is also mandating that shipowners clean dirty ballast water using new equipment by 2024. Price tag? Around $50 billion. In 2018, the IMO also mandated that the maritime industry's carbon emissions be reduced in half by 2050.

Ports also consume a large amount of diesel fuel, aggravating local air pollution in port and port-related corridors which commonly house low-income people and minority populations.[10] Using shore power from the local electricity grid means that auxiliary engines can be turned off while vessels are in-port, helping curb onsite emissions, excluding boilers on-board vessels.

Some ports are on the path to being diesel-free, like the Port of Long Beach which has reduced diesel emissions by 87% since 2005, despite seeing a 21% increase in port traffic.[11] Others, like the Georgia Port Authority are testing four electric rubber-tired gantry cranes that use 95 percent less fuel than diesel-powered cranes, saving almost 2 million gallons of fuel annually.[12]

Physical Security and Monitoring

In the U.S. alone, cargo theft costs $30 billion or more a year, while over 10,000 ship containers disappear at sea.[13] With a global inventory of over 12 million cargo containers, inspection is a daunting task. Ports also have a responsibility to secure their perimeters and protect their employees, data, buildings, equipment, vessels, vehicles, and cargo from a variety of risks including (but not limited to) physical or cyber-attack—any form of which may be considered maritime terrorism. Furthermore, inadequate port security affects national security as well, with potential threats such as smuggled bomb-making materials including those that are radioactive. In addition, smuggling humans and drugs through ports and onboard vessels is also of deep concern.[14]

Risk assessments should identify current port security issues. Remedies may include a combination of both active and passive security measures, which can include vessel hardening, the prevention or defense from acts of piracy, and allowing for low-risk routes to prevent loss.

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10 Shore Power Technology Assessment at U.S. Ports
11 Emissions Inventory Documents, Port of Long Beach
12 1,857,000 gallons of fuel saved annually
13 Smart shipping containers avoid damage, loss, and theft
14 Port Security

Cybersecurity

Ensuring cybersecurity for maritime operations continues to be a challenge. A ransomware attack on a major maritime organization in June 2017, impacted almost 80 ports globally. Some ports shut down completely, creating significant delays for others. According to a recent report from eft (eyefortransport Ltd.) only 35 percent of solution or service providers have a designated Chief Information Security Officer (CISO), 43 percent of shipping companies have a CISO and 21 percent of logistic companies see a need for a CISO. Additionally, employees (55 percent of them) do not know when a cyberattack is happening or what to do about it.[15]

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15 Cybersecurity Concerns Within the Logistics Industry

CUSTOMER SPOTLIGHT

FAST Systems Smart Port Solution

Today's ports seek new ways to manage complexity and maximize operational efficiency, safety, and security. TERRA 4D is designed to address these requirements and provide ports with an integrated vendor-agnostic geo-spatial command and control center solution. TERRA 4D integrates, manages, and visualizes unstructured information from physical sensors and databases. The solution presents structured data in a geographical context offering superior situation awareness in near real-time to all stakeholders in a smart port. TERRA 4D reduces costs of service by increasing efficiency and avoidance of human errors.

Key capabilities:

- Integrate operations applications into a single platform to reduce complexity.

- Improve situation response times and minimize risk.

- Provide a common operating picture enabling superior situational awareness, management and real-time resolution.

- Geo-reference and correlate information from multiple security, safety and operational subsystems to manage and resolve immediate and frequent tasks.

- Intuitive workflows guide operators and remove randomness, reduce stress and enforce compliance for legal and company guidelines.

See TERRA 4D for more information.

IMPROVED SUPPLY CHAIN PERFORMANCE

DECISION MAKING

INFORMATION SHARING

INFORMATION GATHERING
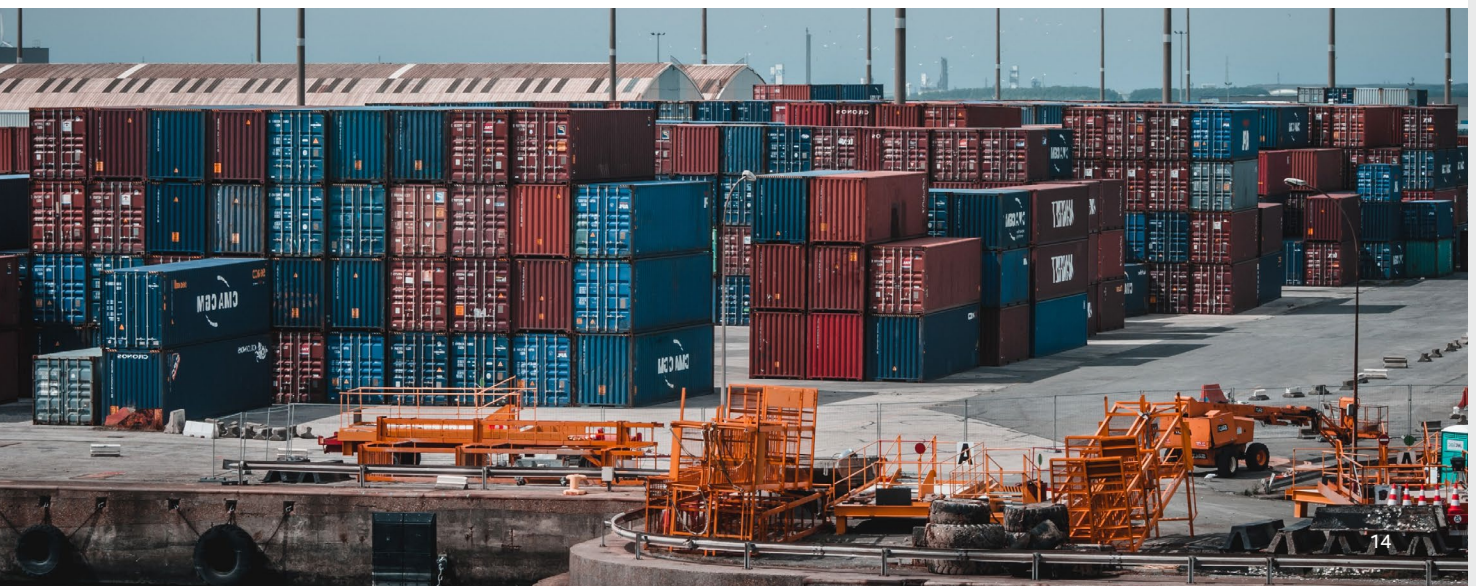
DECISION MAKING based on automatic, regulated data from connected devices and appliances

Algorithmic, for consistent decisions

Feedback-based, so users can instantly check the effects of decisions

Predictive, based on patterns that have been identified by machine learning algorithms

INFORMATION GATHERING from a great variety of connected devices

More types of data coming from sensors

Multiple sources of specific, aggregated data

Higher frequency of data gathered automatically and autonomously

INFORMATION SHARING through WiFi and mobile technologies

Instant sharing, automatically and autonomously

No distortion, with no manual intervention to transfer data between unconnected systems

Non-serial, so data can be shared across trading partners

USE CASES

Use cases are emerging from intelligent maritime initiatives around the world. Maritime Leaders approach innovations of ships and ports in a variety of ways, depending on recent events, physical and infrastructure characteristics, environmental standards and the concerns of the community.

Predictive Scheduling and Traffic Management

The continuous development of the global economy and urbanization has driven the rapid growth of traffic flow. This includes traffic flow to and from ports, which puts huge pressure on the existing transportation infrastructure connected to ports. It has become an important task for transportation authorities in major countries around the world to promote the construction of the Intelligent Transportation System (ITS) through the digitalization of the transportation infrastructure. Traffic monitoring enables the capture of traffic statistical data for port entry, tunnels, and bridges monitoring and control systems to third party ITS-systems. Predictive scheduling in ports can also help to reduce overtime expenses by providing precise insights into probable upcoming issues by scheduling more accurately and necessary skilled personnel.

CUSTOMER SPOTLIGHT

Worldsensing

Worldsensing is using Intel and Dell Technologies solutions to offer solutions for control room operators to manage intelligent infrastructure operations. Control room solutions empower port operators with greater control over operations, traffic flow, parking, critical infrastructures, and construction sites.

These solutions also give ports a better view of operations in near real-time so they can easily create statistics and find ways to gather big data to transform insights into operating efficiency. Worldsensing solutions can be integrated with sensors such as Fastprk for parking management, Bitcarrier for traffic flow monitoring, and Loadsensing for infrastructure monitoring, as well as to 3rd party systems and sensors in order to have a complete overview and control of operations.

Worldsensing helps maritime control room operators to:

- Gain increased awareness and control over operations.
- Obtain actionable results instantly.
- Use near real-time information to make faster and smarter decisions.
- Connect staff, systems, and infrastructure to foster cross-departmental collaboration.
- Decrease operational costs.
- Conduct structural health monitoring on buildings, tunnels, and bridges.

See Worldsensing for more information.

Autonomous Ship Control and Dynamic Positioning

Integrated ship systems play an increasingly important role in operation of vessels. Autonomous ship control helps reduce costs, improves the operation of engines and ship machines, and reduces the likelihood of human errors and accidents. Integrated control and monitoring systems for vessel automation include connecting alarm and monitoring systems, auxiliary control systems, power management systems, propulsion controls, ballast systems, cargo monitoring and controls, and HVAC (air conditioning). Operation dialogues for process elements, for example pumps or diesel-generators, present information on alarm states and operational procedures, assisting operators in making decisions based on accurate data and instructions. Ship automation also enables ship owners and operators to manage their vessels in ways that are more economical and ecologically beneficial, while helping to ensure compliance with safety regulations.

Dynamic positioning systems are designed to minimize fuel consumption and wear and tear on the propulsion equipment. A seagoing vessel is subjected to forces from wind, waves and current as well as from forces generated by the propulsion system. The vessel's response to these forces, including its changes in position, heading, and speed, are measured by position-reference systems, the gyrocompass, and vertical reference sensors. Reference systems readings are corrected for roll and pitch using readings from the vertical reference sensors. Wind speed and direction are also measured by wind sensors. The dynamic positioning system uses all this data to find the optimal vessel speed, draft and trim, route, and engine modes. It also enables weather planning to avoid unfavorable sailing conditions and minimize fuel consumption.

CUSTOMER SPOTLIGHT

Kongsberg Autonomous Shipping

Challenge: The sea can be a hostile environment—dangerous ocean conditions resulted in 1,129 total shipping losses over the past 10 years, mostly due to human error. Enabling a massive vessel—loaded with millions or billions of dollars' worth of goods—to better navigate and detect obstacles and hazards in near real time, requires the crew to have the information they need to make smart and potentially lifesaving decisions.

Solution: Rolls-Royce builds shipping systems that are sophisticated and intelligent to make commercial shipping safer and more efficient. Rolls-Royce's Intelligent Awareness (IA) system uses AI-powered sensor fusion and decision-making by processing data from lidar, radar, thermal cameras, HD cameras, satellite data and weather forecasts. Rolls-Royce's IA system uses AI powered by Intel® Xeon® Scalable processors and Intel® 3D NAND SSDs for storage.

Results: The IA system reduces the potential for human error by automating routine tasks and processes, freeing the crew to focus on critical decision-making. It can potentially lower insurance premiums for vessels, since all the ship's data is stored securely in the 3D NAND SSDs that can provide valuable data on the cause of collisions and other problems. In a recent pilot, Rolls-Royce demonstrated that its vessels can even understand their surroundings at nighttime, when it is not possible for humans to visually detect objects in the water.

See Kongsberg for more information.

AI-Enabled Monitoring and Video Analytics

Global urban populations are expanding. The growth of trade has led to an increased need to monitor cities and transportation systems, including ships and ports. The vast amount of video and optical data generated by traditional monitoring systems requires AI technology to enable new use cases. Optical sensors with embedded video analytics, such as motion, face and object detection, can analyze image data at the point of capture. This can enable more intelligent security for ports and harbors, port assets, coastal and maritime borders, restricted naval/military waters, ships, and vessel traffic monitoring.

AI-enabled monitoring and video analytics on ships and in ports can combine biometric indicators to confirm the identity of stevedores and crew with video analytics to improve security and automate workflows. Alerts can be provided about potential suspects in a crowd, or in an uncontrolled environment, or to detect abandoned packages, boxes, or suspicious items. These systems can help operators protect secured zones in cargo storage areas, control rooms, piers, bridges, tunnels, and other areas from the entry of unauthorized people. Additionally, behavior analytics can detect fights or other unusual situations, triggering instant alerts.

Emergency rescue operations benefit from zone-based people counting capabilities, helping identify and address situational problems. AI-enabled monitoring and video analytics systems can also detect slips and falls to ensure crew and operator safety, while reducing liability. For ship terminals, these systems can help spot issues with customs lines and gangways and assist in locating missing people, assets, or equipment. Unexpected incidents, such as abandoned or unattended trollies, suspicious loitering, sudden crowd gathering, and man-down problems are also detectable. Incidents that require automated quarantine control can be identified, as well as water spills and smoke and fire detection in open-air environments.

CUSTOMER SPOTLIGHT

8 West Consulting

Challenge: In the event of abnormal activity such as sudden impacts, sensor alarms, or weather alerts, all critical data needs to be instantly streamed and made available to an operator. Ship and port operators require visibility into maritime operations and near real-time and historical insights into the use of their vessels and their operational environments.

Solution: SafeTrx Ranger operates as an in-vessel monitoring system measuring and recording vital information. Vessels equipped with SafeTrx Ranger can broadcast telemetry data on a regular basis. All critical data stored in SafeTrx Ranger is instantly streamed and made available to an operator.

SafeTrx Ranger is an intelligent and scalable marine sensor platform that comes equipped with a CAN bus interface, WiFi hotspot, integrated ZigBee, BLE and USB for networking, allowing for seamless communication to the many sensors and systems onboard a vessel. SafeTrx Ranger is fully integrated with GPS, accelerometer, and atmospheric pressure sensors. All the data is accessible in a secure, time-sequenced user interface.

A European Port Authority has equipped a pilot boat with SafeTrx Ranger for daily use. The authority sees health and safety data as a primary value, along with operational efficiencies and environmental data impacting maintenance. The authority intends to deploy Ranger on further pilot vessels and tugs following extended testing.

In a separate pilot in Ireland, the class-leading high-performance open ocean vessel Thunder Child 2 is equipped with SafeTrx Ranger and satellite communications. Thunder Child 2 is capable of streaming live data from the middle of the Atlantic. With the use of a new SafeTrx-compatible, wearable distress device, fully integrated SafeTrx technology can transmit emergency alerts should the crew experience distress at sea. SafeTrx technology is also integrated with autonomous drone dispatch through Donegal-based partner DroneSAR.

Results: SafeTrx technologies help provide benefits to ship and port operators, including health and safety, maintenance efficiencies, and operational value. Operators gain complete access as to how the vessel was handled, providing valuable insights to crew safety. Near real-time problem solving helps drive preventative and emergency response activity from rapid notifications of vessel impacts. Continuous monitoring of vessel operations makes it possible to avert problems such as excess fuel consumption and suboptimal engine usage.

See 8 West Consulting for more information.

Risk Analysis and Route Optimization

End-to-end supply chain risk management can be improved by evaluating current conditions with existing data pools. Big data can be used to mitigate risks by detecting, evaluating, and alerting all potential disruptions on key trade lanes, caused by unexpected events such as growing port congestion or high flood risks. This can be further enhanced through the integration of data from IoT devices.

Dynamic, near real-time route optimization through the intelligent correlation of data streams (shipment information, weather, traffic, etc.) can enable more efficient scheduling of assignments, optimization of load sequences, and 'down-to-the-minute' prediction of the estimated time of arrival (ETA).

Information Management and Supply Chain Optimization

Logistics is being transformed through the power of data-driven insights. Thanks to the vast degree of digitalization, unprecedented amounts of data can be captured from various sources along the supply chain. Capitalizing on the value of big data offers massive potential to optimize capacity utilization, improve customer experience, reduce risk, and create new business models in logistics. Smarter forecasting of demand, capacity, and labor through big data analytics can significantly optimize planning and resource utilization, process quality and performance, and can reduce unnecessary costs in the supply chain. Anticipatory shipping can be used by online retailers who have analyzed their customers' purchasing behaviors to predict an order before it occurs. This can then be used to move goods to distribution centers that are closer to a customer who is likely to purchase the products. It can enable retailers to offer same-day or even one-hour deliveries.

CUSTOMER SPOTLIGHT

◆NALTA

North Sea Port

Challenge: North Sea Port is Dutch-Belgian logistics hub and port authority which emerged from the 2018 merger of Zeeland Seaports in the Netherlands and the Port of Ghent in Belgium. Measured by added value to the economy, North Sea Port is the third most valuable logistics hub in Europe. North Sea Port facilities stretch along a 60-kilometer cross-border port area from Vlissingen on Holland's North Sea coast in the Netherlands to some 32 kilometers inland into Belgium. Just to handle shipping, it has over 25 miles of quay walls, and in the first nine months of 2019, North Sea Port companies recorded a volume of 54 million tons sea freight shipment, almost two percent up over the same period in 2018. North Sea Port's technology infrastructure underpins the effective, friction-free distribution of all the multiplicity of goods entering the port from all over the world then on via inland shipping, rail, pipelines and motorways—with one direct rail connection running all the way to China. To remain among the top European ports, North Sea Port needed to integrate an immense amount of data and applications.

Solution: To build the kind of IT architecture necessary to integrate its data and applications, North Sea Port turned to Nalta, a digital transformation partner, and Integration-Platform-as-a-Service (IPaaS) specialist Boomi, part of Dell Technologies since 2010, to deliver application/data integration, API management, data quality governance, B2B integration and even low-code app development. Boomi offered a way to integrate, at scale, the kind of Internet of Things (IoT) capability North Sea Port needed to capture the data it wanted.

Results: With the Nalta and Boomi solution, North Sea Port is now able to have constant, secure access to data for making crucial decisions that determine the success of businesses. Shipping is never stationary, and so the flow of data that drives it needs to be not only secure but instantly accessible. Cloud integration is highly useful for North Sea Port, enabling data to be intrinsically linked and connected via a centralized hub. By using GPS data from vessels, North Sea Port can optimize the whole process of shipping and create a centralized way to control the flow and security of data.

See Nalta for more information.

Fleet and Asset Management

Fleet and asset management solutions use Edge and IoT hardware and software to increase the visibility, integrity, and security of assets as they move around a ship, through a port, or through the supply chain. Ship and port operators gain near real-time tracking and monitoring of asset location, temperature, humidity, shock, ambient light, pressure, and tilt. Comprehensive dashboards enable effortless monitoring and analysis; and may include programmable notifications and alerts for quick intervention.

Fleet and asset management solutions can help operators track and monitor high-value, sensitive equipment. Excessive tilt or shock can damage large, costly items such as cranes, forklifts, vehicles, or other machinery. Real-time dashboard alerts for location help operators address this challenge. With cost-effective GPS-enabled tracking along the entire asset journey, sensors can detect near-real-time changes in the environment and conditions, reporting if a single asset is separated from others to help prevent theft, loss, or damage.

CUSTOMER SPOTLIGHT

Container Shipping Company

Challenge: One of the world's leading container shipping companies is navigating a journey to improve operational efficiencies for its global ocean transportation services business. The company sells container capacity to customers and charter vessels, in addition to owning them, and its ships carry almost one-fifth of the world's containers and operates in 120 countries. Maritime organizations have thousands of seagoing vessels carrying containers of varying ages that need to be updated with the latest technology to collect, store and analyze critical data. To stay competitive, they must implement a digital transformation strategy and meet stringent environmental regulations. The updated IT solutions adopted are often operating in remote locations, causing consistent connectivity.

Solution: The container shipping company leveraged the Dell EMC Rugged Extreme Remote Data Centre Appliance (RE-RDA), a robust fit-for-purpose, pre-integrated HCI infrastructure solution based on VMware Software Defined Data Centre (SDDC) and Intel technologies, while also delivering an advanced Virtual Desktop Infrastructure (VDI) user experience with VMware Workspace One. In addition to the RE-RDA, there are options on client devices, wireless networking and data protection.

Results: This solution allowed the container shipping company to operate fully independently, without connection to a central data center. It includes effective tools for remote operations and a managed service hub that is easy to manage for the staff. Problems such as limited bandwidth at sea, high latency issues, and security concerns heightened by weather, piracy and cyber-crime threats, are mitigated.

Predictive Maintenance

As the complexity and interconnectivity of various aspects of the maritime ecosystem grows, predictive, (or 'just-in-time') maintenance grows in value. With innovative maintenance technologies, it is possible to integrate diverse sets of equipment, systems, and platforms. Behavioral indicators can be sent from each asset to be analyzed at the Edge. Precise actions and responses are recommended, including predictive maintenance when necessary. This improves operational efficiency and increases productivity by providing just-in-time analysis of engine parts, low-voltage motors, and other mechanical devices. It reduces the cost of sending maintenance crews on expensive regular rounds and can decrease the frequency of accidental breakdowns.

CUSTOMER SPOTLIGHT

Arundo Analytics for European Global Shipping Company

Challenge: Maintaining sufficient quantities of potable water onboard an underway vessel is one of the most critical elements to ensure the safety of crew members and safe operation of the vessel itself. While sea water may be satisfactory for washing decks and flushing toilets, fresh water must be maintained for human consumption and power generation. Crew members face multiple operational challenges in optimizing portable water quantity planning, including trip variables such as voyage length, consumptions rates, crew manifests, and fuel costs. If optimized and managed correctly, the savings can be tremendous for ship operators. For example, the weight and space created by eliminating excess water tanks can be used to store extra fuel or cargo, leading to millions of dollars in additional savings per year.

Solution: Arundo Analytics partnered with a global shipping company to optimize the potable water availability process across its fleet of European vessels. Before vessel departure, the Arundo solution interrogates multiple onboard data sources to analyze variables such as ship type (e.g. bulk carrier, container ship), the expected number of crew, voyage length, and onboard system capability to generate potable water to predict the volume of potable water required for the voyage. During the voyage, the system uses live onboard sensor data to track actual potable water consumption, temperature patterns, and travel speed to adjust bunkering and docking locations as needed. When deviations occur, crew members receive early warning alerts and are rerouted to nearby distilling sites, ensuring the safety of all crew aboard. The Arundo system's algorithms continue to adapt and gain accuracy with each voyage.

Results: Arundo Enterprise was tested on a fleet of seven client ships across both short and long-haul voyages. The solution helped to safely reduce the ships' on-vessel water quantity by 15 percent, leading to significantly decreased fuel usage and increased cargo space. Each ship could save more than $200,000 a year, and the customer expects to save upwards of $5M annual operating costs. In addition to cost savings, the customer realized a substantial environmental benefit, leading to a meaningful gain in its sustainability target. The customer plans to expand deployment of the solution on up to 50 ships.

SOLUTIONS FROM INTEL AND DELL TECHNOLOGIES

Accelerating Innovation in Intelligent Maritime

Dell Technologies is working with Intel and partners across the globe to develop, test, and deploy the technologies and networks that make the vision of intelligent maritime a reality. Together, Intel and Dell Technologies enable maritime organizations to build Edge to Cloud infrastructure that adapts and scales to help ship and port operators to sustain, grow, and protect their data, cargo, workers, environment and ultimately their business.

Edge and IoT, AI, video sensors, and analytics are all converging to create new value across maritime systems. But the applications of the future will not run on the technology of the past. New capabilities from Intel and Dell Technologies are performance-optimized, cloud-ready, and can excel even in space- and power-constrained environments. These proven solutions can help reduce cost and complexity by consolidating data and applications, even while delivering new capabilities like vision and insights. This means maritime organizations can improve efficiency, reduce total cost of ownership (TCO) with a consistent infrastructure, and create safer ships and ports.

SOLUTIONS FROM DELL TECHNOLOGIES

Dell Technologies Marine Type Approved IT solutions are built to the highest standards of safety, quality and efficiency and are specially engineered for use in the marine and offshore industries. The portfolio includes servers, IoT gateways, embedded box PCs, workstation and networking solutions designed to comply with classification standards for temperature, humidity, vibration, electro-magnetic compatibility and enclosure location classes. Dell Technologies also provides dedicated engineering, program management, extended lifecycle products, customization and configuration, and marine services and support. As well as being Marine Type Approved, the range has also passed MILSTD (Military Standard) rugged tests, again proving the robust design of the OE&E Edge portfolio.

Together, Intel and Dell Technologies are helping them get smarter and more connected.

How Dell Technologies is Helping Turn the Tide on Ocean Plastics

Eight million tons of plastics end up in our oceans every year causing harm to wild life and their ecosystem. To combat this, Dell Technologies has created a new supply chain that significantly increases the use of recycled plastic, keeping it out of the ocean and landfill. By working with organizations to collect, process, and mix plastics with other recycled material to create molded trays used for packaging select products, Dell Technologies has used 100 million pounds of recovered materials in its products since 2014.

- **Re-using plastics from electronics:** In 2018 alone, Dell Technologies used 13.7 million pounds of e-plastics. Since the 2015 fiscal year, over 35 million pounds of e-plastics have been sent to molders to make components for 125 different desktop and monitor product models.

- **Using post-consumer packaging:** Dell Technologies used 7.7 million pounds of post-consumer plastics sourced from packaging such as water bottles and CD cases in 2019.

- **Recovering windshield plastics:** Dell Technologies is using recovered polyvinyl butyral (PVB) from car windshields to create a protective, water-resistant coating on laptop bags and backpacks.

- **Sourcing ocean-bound plastics:** Last year, Dell Technologies used over 18,000 pounds of HDPE that would otherwise be at risk of entering the sea. In 2018, the ocean bound plastic went into 441,000 packaging trays, consisting of 25% ocean-bound HDPE and 75% post-consumer HDPE.

- **Reclaiming carbon fiber:** In 2018, Dell Technologies used 636,000 pounds of reclaimed carbon fiber from the aerospace industry. Overall, Dell Technologies has used over 2 million pounds of carbon fiber, which is incorporated into the company's laptop bases and backs.

- **Partnering up and creating initiatives:** Together with Lonely Whale, Dell Technologies created the Next Wave initiative, an open-source initiative that brings the world's largest companies together in a combined effort to solve this crisis.

- **Keeping our oceans clean together:** The group aims to save over three million pounds of plastic from entering the oceans within the next five years. Join our cause by visiting nextwaveplastics.org and learn more about ocean-bound plastics here.

Dell Edge Gateways for IoT

Because ships and ports are already data-rich environments, they are well-positioned for the opportunity to aggregate that data for near real-time insights. The captain, crew, and ship operators can utilize data from many legacy devices in the environment that may have previously been operated independently. By networking devices to communicate across systems, it is possible to achieve digitalization and provide a single pane of glass to the captain and crew alike, which can then reduce costs while increasing efficiency. Additionally, the solution does not require a complete overhaul of equipment, but can build from what is existing. This is the challenge that Dell Technologies and Intel have set out to solve with a dedicated solution portfolio for maritime organizations.

Edge gateways can break down the individual information silos and become a repository and access point that helps turn data into actionable information. Empowered by Edge gateways, maritime operators now can integrate new applications into ships and ports. The ability to combine legacy data sources can drive new insights into operations, help uncover new revenue streams, and improve ship, port, operator, and maintenance efficiencies overall.

Made to withstand harsh conditions, Dell Edge Gateways for IoT empower computer vision and visual sensing networks to expand in new directions. Ruggedized, with a variety of input/output connections, they aggregate data and support analytics at the Edge of the network. With protection built in, Dell Edge Gateways include hardware features that help protect the network Edge and sensors from cyberattack, including a secure boot and BIOS-level control. Maritime organizations can minimize network cost while securing IoT data at the network Edge. Dell Edge Gateways perform local analytics and near real-time actions where network latency is a problem.

The Dell Edge Gateway 3000 Series and **5000 Series** offers extreme rugged and unique benefits for maritime organizations for Edge Compute. Built on Intel and driven by Ubuntu Linux or Windows 10 IoT, the Dell Edge Gateway systems offers the broadest range of support for existing maritime applications and provides headroom for integrations and applications to come. With a broad range of connectivity options for ships and ports today and tomorrow, from CANbus to Zigbee for mesh, along with traditional Wi-Fi, Bluetooth, and WWAN (3G or 4G LTE), the Dell Edge Gateway systems enables operators to choose their preferred networks and devices for today's environment and tomorrow's demands. Sensors in the device itself include built-in GPS, an accelerometer, and even an atmospheric pressure sensor. The Dell Edge Gateway systems are ruggedized from the start, designed to handle 24x7x365 operation over a 100-degree range from -30 to 70C, whether wall, DIN, or VESA mounted or installed under the dash of a truck. Since Dell Technologies has a global footprint, operators can expect the same access to global support and deployment services and world-class global supply chain that they would for any Dell Technologies product or service.

The Dell Embedded PC 3000 Series and **5000 Series** offers rugged compute, with similar capabilities to the Gateway Series, but with expanded CPU, Connectivity and IO. These systems offer Edge compute for less extreme locations and are designed to be embedded into solutions.
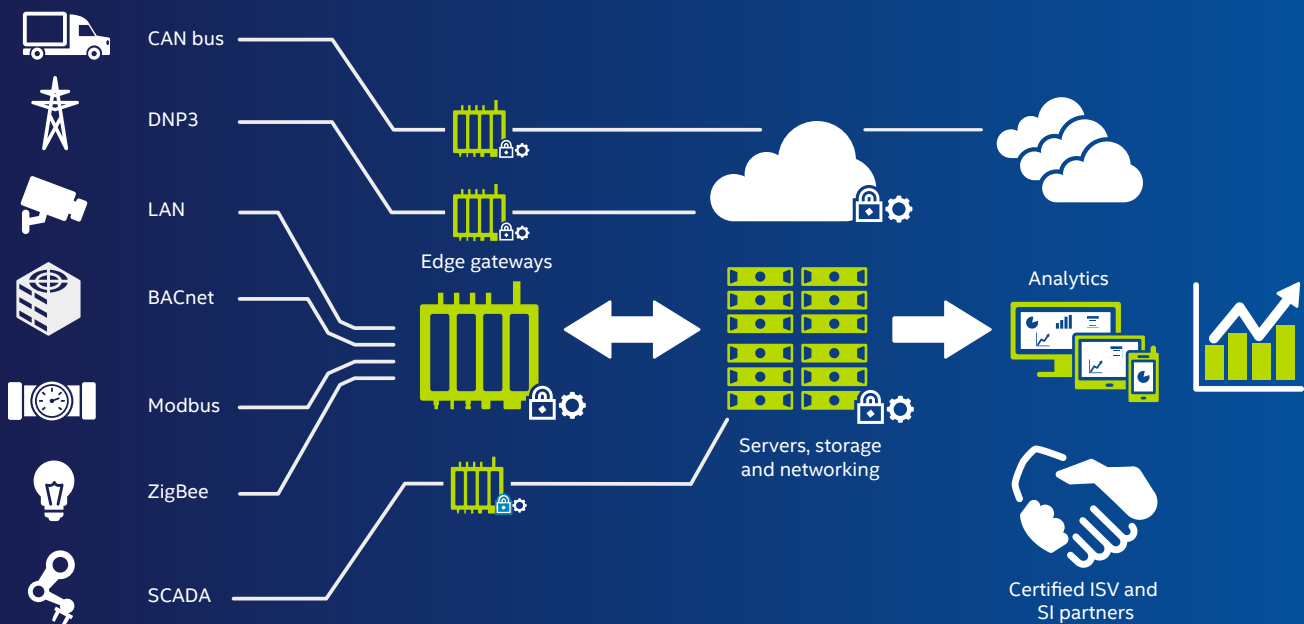
For more information on Edge and IoT solutions from Dell Technologies, go to www.delltechnologies.com/IoT

Dell Optiplex XE3 Industrial Grade PC

The Optiplex XE3 is an industrial grade PC that includes Marine DNV GL Type Approval. It includes Intel® 8th generation processors that allow for the fastest desktop compute experience in a small form factor or mini desktop chassis. Next-generation discrete graphics, robust SSD, and hard drive options provide ample power for applications of today and the future. Sustainably built with premium materials, the Optiplex XE3 is designed for high heat tolerance up to 45º C ambient. In addition to Marine certification, the XE3 stands up to rigorous testing.

The XE3 is a highly flexible and capable platform with an extended lifecycle of up to 5 years, and can be customized with an optional filtered bezel, offering the marine industry the latest technology in a compact form factor, designed for 24x7 operation on board vessels or in ports.

Dell EMC PowerEdge XR2 Rugged Server

Mission-critical systems are typically comprised of marine approved hardware for the supply chain including engine manufacturers, power, propulsion, control rooms, navigation equipment, satcoms, visual sensing, HVAC, water purification, pumping, and scrubbers.

As a leading marine approved server, the Dell EMC PowerEdge XR2 is the best in rugged 1U short-depth computing, including DNV GL Type Approval. This server offers a platform for software-defined storage in space-constrained installations. Deliberately designed to take the hardest conditions head-on, the new PowerEdge XR2 features the latest Intel® Xeon® SP processors and brings together the best combination of functionality and value in the industry, plus extensive customization options from OE&E services.

Secure, anytime access provided by industry-leading iDRAC (integrated Dell Remote Access Controller), plus integrated lifecycle controller support for maritime maintenance and management needs.

The flexible configuration options and global support availability maritime organizations expect from a Tier-1 vendor. Enterprise-grade common components and platform ensure consistency from the data center to the field with quality and reliability at every turn. The XR2 features functionality for dual processors, redundant hot-swappable power supplies, and up to eight hard drives. It's the ideal balance of portability and power and fully configurable for rugged maritime industry needs.

The Dell EMC OEM PowerEdge XR2 server has been tested to and achieved DNV GL Type Approval. It's 20 percent less deep than a standard server and can operate continuously while withstanding heat up to 55 degrees Celsius. Its shock-resistant design supports operation in extreme vibration and up to 40G shock.

The OE&E Marine server platform also has certification for VMware VSAN, offering scalable and high availability clustering for rugged environments. This allows the deployment of Hyper-Converged Infrastructures (HCI) and Virtual Desktop Infrastructures (VDI) on board vessels, with Type Approved hardware. VMware VSAN and the VMware Cloud Foundation suite of solutions also offer the deployment of private and/or hybrid cloud solutions on vessel, with integration and management with many public cloud platforms such as AWS, Azure, and Google. The marine servers also support Dell EMC VxFlex Software Defined Storage (SDS), again offering high performance and availability data storage solutions for on vessel use. Added to this is a comprehensive portfolio of Data Protection solutions, offering advanced data protection, backup and recovery capabilities.

Dell Technologies Storage Solutions

Dell Technologies OE&E storage solutions bring together technology and the expert people who power it all. Embedded within Dell Technologies, our OEM resources are a dedicated team of engineers, project managers, trusted partners, and consultants that can help maritime organizations custom-build solutions, to ensure customers get the most out of their data, with a longer lifecycle and consistent quality of a tier-1 vendor. As the global leader in storage solutions, Dell Technologies powers many of the top organizations in the global maritime industry.

Dell Technologies storage platform components:

- **Dell EMC PowerVault:** The PowerVault ME4 Series brings the essential features of high-end storage with simplicity and affordability. Starting in a 2U form factor, these systems drive higher application performance for a wide range of business applications.

- **Dell EMC Unity XT:** Dell EMC Unity family is available in all-flash, hybrid, or Virtual Storage Appliance (VSA) and delivers high performance and low latency to a broad range of SAN and NAS use cases. The modern architecture is designed for performance, rich data services, simplicity, and affordability — all starting in a 2U footprint.

- **Dell EMC Isilon:** The Isilon scale-out storage family offers massive scalability, flexible deployment options, and simplified management for large-scale file and unstructured data assets. With its high storage efficiency utilization rates and single-volume architecture, Isilon delivers the right blend of performance and capacity for a wide range of workloads.

- **Dell EMC ECS:** Bridge traditional and modern apps with ECS object storage. With one object storage option designed for unlocking insights from both traditional and next-gen workloads, ECS enables organizations to store and manage unstructured data with public cloud-like scalability and flexibility.

- **Dell EMC VxRail:** Powered by VMware vSAN and Intel® Xeon® Scalable processors, VxRail is a fully integrated, preconfigured, pre-tested VMware hyperconverged infrastructure appliance that is jointly engineered by Dell EMC and VMware.

- **Dell EMC VxFlex:** Powered by the VxFlex OS, the VxFlex family delivers unmatched performance, resiliency, and flexibility for applications and databases. The VxFlex family consists of a VxFlex integrated rack the Ready Nodes and a VxFlex appliance.

- **Dell EMC Data Domain:** Maritime organizations can protect their data with industry-leading Dell EMC Data Domain solutions. Deployment options range from backup appliances to software-defined solutions that can run in the cloud. Data Domain backup appliances reduce the amount of disk storage needed to retain and protect data by utilizing efficient deduplication technology. Dell EMC Data Domain Virtual Edition (DD VE) is simple to configure and deploy and can be up and running in minutes.

Dell Technologies IoT Solutions

Dell Technologies, Blue Dot, Microsoft, and HMS Industrial Solutions have collaborated on a solution that combines Blue Dot's innovative Miles Ahead Fleet Transformation software with Dell's Edge Gateway hardware powered by Intel, HMS's CANbus adapter, and Microsoft Azure Cloud Platform to provide a powerful Open IoT and Unified Digital Experience to the T&L industry. Operators are more self-sufficient because they have the information that they need exactly when they need it, presented in a way that is easy to use. Data is more timely and accurate as it is automatically synchronized and is often the product of dedicated sensors or digital interfaces. Decoupled systems support a future-proof process, allowing for the addition of new technology and solutions over time.

Ships and ports use IoT solutions to analyze traffic and understand the impact of ship movement on port facilities and logistics. Key IoT use cases include:

- **Predictive Maintenance:** Maritime customers use Dell Edge Gateways to run analytics for predictive maintenance of diesel engines and elements of the propulsion package and aft ship systems. These analytics help contribute to a reliable maintenance program for engines, reduction gearboxes, propellers, automation, and control systems.

- **Smart Fleet Operations:** IoT systems track ships and other transportation assets (trucks, railroad cars) and determines and/or controls optimal routes. By relying on industry-standard technology, Dell Technologies has delivered a future-proof, commercial off-the-shelf design, for around the clock fleet management operation and years of uninterrupted service that vessel operators can depend on.

- **Onboard Vision:** Maritime customers are fitting ships and drilling rigs with advanced vision systems, which enable naval vessels to be safer with all the advantages of open platform video technology. These are very different from most land-based solutions because all marine installations must withstand high levels of corrosion, vibrations, shock, and extreme temperatures, while at the same time be highly resilient and provide non-stop operations.

- **Port Operations:** The shipping industry faces the challenge of transporting millions of containers, as well as ensuring safety and border control. With a widespread and complex site, computer vision provides an effective overview for port authorities. The integration of third-party systems, such as container ID tracking or geographic information system (GIS) mapping, enables site-wide coordination and efficient port operations.

- **Cargo Monitoring:** IoT for cargo management (via sea, air, railroad, or land) is based on the technology of radio frequency identification (RFID), global positioning system (GPS), GPRS, and GIS, and creates an intelligent, internet-connected maritime transportation system.

- **Ship-to-Ship (S2S) and Ship-to-Infrastructure (S2I):** Technologies that help increase situational awareness and reduce or eliminate crashes. S2S/S2I assist in ship safety assurance and act as an infrastructure enabler for other connected ship use cases (emergency, security, infotainment).

- **General Infrastructure:** Ships and ports use IoT solutions to analyze traffic and understand the impact of ship movement on port facilities and logistics. Sensors, cameras, transponders, and other systems allow authorities to track the flow and use of infrastructure, as well as the structural integrity of the infrastructure itself.

Dell Technologies Edge and IoT Solutions for Safety and Security

Because ports are important collection, distribution, and transportation nodes, port security has a direct impact on local cities and residents. Likewise, on vessel security continues to be a key concern. Reducing supply chain risks requires agile, flexible risk management strategies. The deployment of highly available, expandable and performant safety and security solutions in port and on vessel is a growing requirement across the globe.

The Dell Technologies IoT Solution for Safety and Security, built on Intel, delivers true vision by enabling organizations to see visual data from any number of data streams, while allowing them to think, plan, and act in ways that benefit the security and safety of the organization. This true vision extends into five key areas:

- **HCI solution** is a robust and proven from Dell Technologies portfolio that is integrated into a single appliance consisting of world's leading storage and best infrastructure solutions.

- **Trusted** solution that is tested and validated for and by VMware, the leader in enterprise virtualization. Our global labs and certification program ensure proper sizing and interoperability of Dell Technologies and partner solutions.

- **Automated** deployment options reduce time to value.

- **Transparent** environment that encompasses the entire solution – power, servers, virtual machines, storage, and network via a centralized management console.

- **Scalability** future-proofs organizations for expanding requirements and new use cases.

The solution combines the world's leading server platform, leading storage platforms, and leading virtualization software to create an all-in-one pre-validated and pre-defined appliance specification, optimized for safety and security, validated in our labs, and wrapped in global services and support. From the Edge to the core to the cloud, this comprehensive portfolio of technology solutions demonstrates the power of the Dell Technologies family of brands is better together. By aligning our business to our company strategy, we're able to deliver technology across the full IT ecosystem through all the businesses under the Dell Technologies banner: Dell Technologies, Dell EMC, Pivotal, RSA, SecureWorks, Virtustream, and VMware. We stand aligned towards a singular goal: enabling human progress by helping our customers transform for the future. With the Dell Technologies IoT Solutions for Safety and Security, organizations can incorporate the true vision perspective of Dell Technologies and its global partners into their safety and security planning.

SOLUTION SPOTLIGHT

American Bureau of Shipping

Challenge: The American Bureau of Shipping (ABS) is a maritime classification society established in 1862. Its mission is to promote the security of life, property, and the natural environment, primarily through the development and verification of standards for the design, construction, and operational maintenance of marine and offshore assets. With Windows 7 end of support approaching, the organization needed to determine how to upgrade computers for its global workforce.

Solution: With surveyors in every major port, working in environments on the water, ABS needed a solution that would perform in maritime environments. The organization worked with Dell Technologies to replace computers holistically, with new Dell Technologies machines running Windows 10 natively.

Results: Dell Technologies provided the global reach ABS required and the value of Pro Support Plus and Pro Deploy. ABS transitioned from Windows 7 to a consistent Windows 10 operating system across the entire organization.

For more information: [Video](#)

Dell Technologies Cyber Security Solutions

Today's cyberattacks are unparalleled in sophistication and frequency. The potential attack surface for organizations is only growing. Trusted endpoints no longer reside just within the organization's four secure walls. Deployment of Edge Compute is growing in the maritime industry and solutions are deployed on ship and on shore, often on untrusted networks and then brought back into the trusted environment. Edge Compute and endpoints remain the most vulnerable attack vector. Today's threat actors are more tenacious than ever before.

The reality of today's cyberthreats mean it is generally not a matter of "if" an organization will be compromised, but rather "when." Threats are personalized, complex, and never-seen-before in the wild. Complicating matters further, security solutions that traditionally rely on signatures or rules, such as antivirus software on endpoints, are simply unprepared for these new, more adaptable unknown threats. When an organization is inevitably compromised, security teams and incident responders quickly discover that they may be unable to get real, deep visibility into all critical endpoint activity surrounding the compromise. They may also face challenges in detecting those hidden, never-seen-before, and targeted threats. They may also be confronted with thousands of alerts from traditional security solutions that complicate the quick detection, accurate analysis, and efficient response to the real threats to the organization.

The **RSA NetWitness Suite** is part of Dell Technologies that offers industry-leading cyber security software and services. RSA NetWitness Endpoint is an endpoint detection and response tool that continuously monitors endpoints to provide deep visibility into and powerful analysis of all behavior and processes on an organization's endpoints. RSA NetWitness Endpoint does not require signatures or rules. Instead, leveraging unique endpoint behavioral monitoring and advanced machine learning, RSA NetWitness Endpoint dives deeper into an organization's endpoints to better analyze and identify zero-day, new, and hidden threats that other endpoint security solutions miss entirely. As a result, incident responders and security teams gain unparalleled endpoint visibility allowing them to more quickly detect threats they may have not seen before, drastically reduce threat dwell time, and focus their response more effectively to protect their organizations.

But cyber security does not end at the Edge. RSA Netwitness Endpoint is part of the broader RSA NetWitness® Suite, providing pervasive visibility, enabling faster detection, investigation and response to security incidents. The RSA NetWitness Suite consists of powerful modular solutions which together deliver threat detection and response capabilities that provide the fastest path to identifying threats regardless of the threat vector, enabling maritime organizations to create a robust and secure architecture from Edge to core to cloud:

- **RSA NetWitness® Logs and Packets** provides security visibility across your infrastructure, from on-premise to public cloud services. By capturing real time data from logs, network packets and NetFlow data, it can then analyze this data using event stream analysis and behavior analysis models, to detect and recognize threats before the adversary can cause any damage.

- **RSA NetWitness® Endpoint** is an endpoint detection and response tool that continuously monitors assets – such as laptops, servers, and virtual machines – to provide deep visibility into and powerful analysis of all threats on an organization's endpoints.

- **RSA NetWitness® SecOps Manager** provides a solution to help better prioritize, investigate and respond to security incidents by automating and orchestrating your people, process and technology in a repeatable way.

- **RSA Advanced Cyber Defense Practice** provides services to assess and develop your SOC strategy, readiness and resilience.

- **RSA Incident Response (IR) Practice** provides services to help organizations detect and investigate incidents and breaches in order to identify root causes and develop containment and remediation plans.
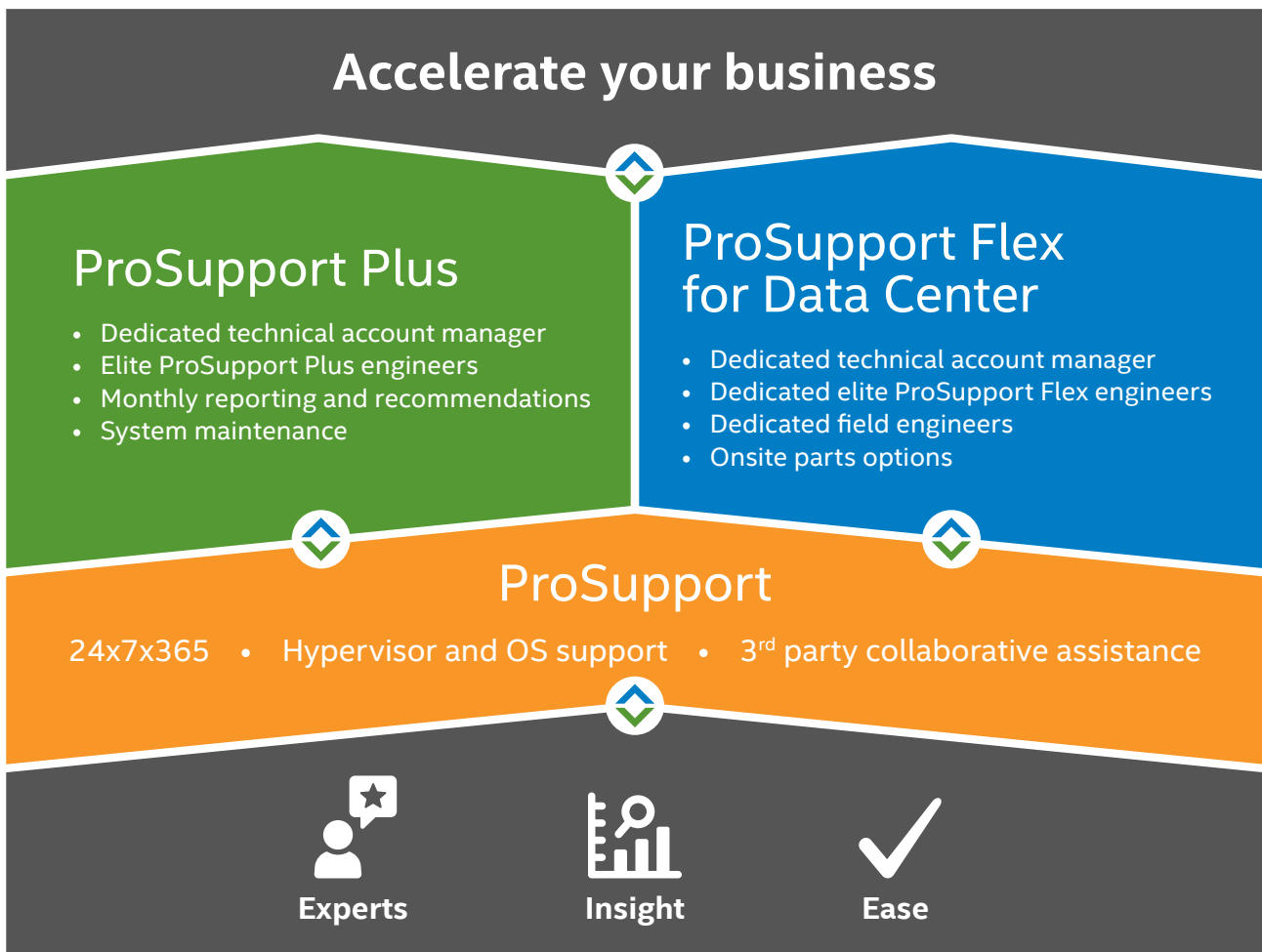
The RSA NetWitness Suite helps take organizations to the next level of security for better detection, investigation, and response to security incidents.

Dell Technologies ProSupport Enterprise Suite

Maritime organizations can multiply their impact with Dell Technologies' team of more than 55,000 technical experts supporting more than 160 countries. As the maritime technology landscape changes rapidly, the pressure to introduce new solutions into an organization while efficiently maintaining existing infrastructure has never been greater. Virtualization, application modernization, converged infrastructure and cloud computing can result in substantial benefits, but they require an even higher level of expertise. A complex environment means complex processes and more potential problems. When an organization works with multiple vendors to keep servers, storage, and networking up and running, the environment can get difficult very quickly. Today's complex environments require true enterprise-class support.

With the experience of global support and servicing solutions already deployed in ports and on vessels throughout the world, Dell Technologies can help shift more of an organization's focus to where it should be—on the business. With the **Dell ProSupport Enterprise Suite**, organizations get the most out of their investment with the support expertise and insights for which Dell Technologies is known across the globe. The Dell ProSupport Enterprise Suite extends an organization's IT team and helps ensure nearly every question and every problem can be resolved, every time. The Dell ProSupport Enterprise Suite offers:

- Flexibility to choose the right support based on the criticality of specific systems
- A single point of contact for all hardware and software issues
- Broad and deep experience that goes beyond a single system
- Proactive, automated tools and innovative technology
- Consistent experience regardless of where an organization is located or preferred language

Accelerate your business

ProSupport Plus
- Dedicated technical account manager
- Elite ProSupport Plus engineers
- Monthly reporting and recommendations
- System maintenance

ProSupport Flex for Data Center
- Dedicated technical account manager
- Dedicated elite ProSupport Flex engineers
- Dedicated field engineers
- Onsite parts options

ProSupport
24x7x365 • Hypervisor and OS support • 3rd party collaborative assistance

Experts **Insight** **Ease**

Together, Intel and Dell Technologies are bringing new capabilities to the Edge with performance optimized, cloud-ready solutions that excel even in space- and power-constrained environments. These proven solutions can help reduce the cost and complexity of IT by consolidating data and applications, even while delivering new capabilities like vision and inference. This means maritime leaders can improve efficiency, reduce total cost of ownership (TCO) with a consistent infrastructure, and create intelligent ships and ports.

	Edge & Embedded	Small Deployment	Medium Deployment	Large Deployment	Hyper-converged
Manage/ Orchestrate		Virtualization / Orchestration / Automation / Dashboard / Analytics			
Command/ Control			vmware	Dell PowerEdge R740xd — Sizing based on use cases	
Video Analytics			vmware	Dell PowerEdge R740xd — Intel HDDL	
Computer Vision	INTEL XEON, INTEL CORE, AND INTEL ATOM PROCESSORS — INTEL FPGA — INTEL MOVIDIUS VPU TECHNOLOGY — SOFTWARE: INTEL MEDIA SDK AND INTEL DISTRIBUTION OF OPENVINO TOOLKIT				
Video capture	Smart Cameras; Edge Gateways and Embedded PCs	vmware — Dell PE R Series Servers R740xd, R640, R540, R440 — *With internal or Direct Attached Storage*	vmware — Dell PE R Series Servers R740xd, R640, R540, R440 — *With Dell EMC Unity SAN based block Storage*	vmware — Dell PE R Series Servers R740xd, R640, R540, R440 — *With Dell EMC Isilon – A2000 Clustered NAS Storage*	Dell IoT S|S HCI + ECS — vmware

SOLUTIONS FROM INTEL TECHNOLOGIES

Taking AI to the Network Edge

As maritime organizations connect more devices to the Internet and the need for near real-time intelligence grows, more AI inference will move to the Edge of the network to avoid the need for data transfer to the cloud. One of the most important ways to move AI to the Edge is with federated learning. This process enables Edge devices to collaboratively learn a shared prediction model while keeping all the training data on the device, decoupling the ability to enhance models from the need to store data in the cloud. This also enables devices to be used for model training. The device downloads the latest model, improves it by learning from data on the device, and then summarizes the changes as a small, focused update. Only this update is sent to the cloud, using encrypted communication, where it is immediately averaged with other user updates to improve the shared model. All training data remains on the Edge device, and no individual updates are stored in the cloud.

For more information on solutions for AI at the Edge, visit Intel® AI in Production.

Compute Acceleration with Intel® Artificial Intelligence

A growing customer requirement in solutions designed by Dell Technologies, is the provision of acceleration and offload solutions to boost the compute performance of platforms. The partnership of Dell Technologies with Intel offers the industry's most comprehensive suite of hardware and software technologies that deliver broad capabilities and support diverse approaches for AI—including today's AI applications and more complex AI tasks in the future. Intel's AI portfolio helps customers enable AI model development and deployment at any scale from massive clouds to tiny Edge devices, and everything in between. Intel is leading the next wave of AI with new products designed to accelerate AI system development and deployment from Edge to core to cloud.

Intel® Movidius™ Myriad™ Vision Processing Unit (VPU)

Intel's next-generation Intel® Movidius™ VPU is designed for Edge media, computer vision, and inference applications. The technology incorporates unique, highly efficient architectural advances that are expected to deliver leading performance—more than 10 times the inference performance as the previous generation—with up to six times the power efficiency of competitor processors.

Additional technologies supporting AI include:

- **Intel® Vision Accelerator Design products:** Based on Intel® Movidius™ VPUs and Intel® Arria® 10 FPGAs, the Intel® Vision Accelerator Design products provide powerful, deep, neural network inference for fast, accurate video analytics to meet the demands of computer vision applications at the Edge and to enable solution providers and their customers to take advantage of a wide spectrum of video analytics-based use cases.

- **Intel® Xeon® Scalable processors:** powerfully designed to handle the broadest range of AI workloads including deep learning.

- **Intel® FPGA:** Near real-time, programmable acceleration for deep learning inference workloads.

Computer Vision with Intel® Distribution of OpenVINO™ Toolkit

The **Intel® Distribution of OpenVINO™ Toolkit** is a comprehensive toolkit for quickly developing multiplatform applications and solutions that emulate human vision. Based on Convolutional Neural Networks (CNNs), the toolkit extends Computer Vision workloads across Intel® hardware, maximizing performance. Maritime organizations can accelerate and deploy CNNs on Intel platforms with the Intel® Deep Learning Deployment Toolkit that's available in the OpenVINO™ toolkit and as a stand-alone download. Together with the new **Intel® DevCloud for the Edge**, OpenVINO addresses a key pain point for developers—allowing them to try, prototype and test AI solutions on a broad range of Intel processors before they buy hardware. The OpenVINO™ toolkit:

- Enables CNN-based deep learning inference on the Edge.

- Supports heterogeneous execution across computer vision accelerators—CPU, GPU, **Intel® Movidius™ Neural Compute Stick**, and FPGA—using a common API.

- Speeds time to market via a library of functions and preoptimized kernels.

- Enables development and optimization.

Intel 5G

From device to network to cloud, Intel is leading the way in developing 5G technology that will shape the future of connectivity. The next generation of wireless, 5G is a complete revolution in the way data and services will be consumed on a network, offering higher speeds, more capacity, and lower latency. With the move to 5G, Intel-powered networks help maritime organizations become AI ready– with the compute power to handle networking, cloud, and AI workloads. Transformed networks with powerful computing resources at the Edge enable operators and cloud providers to intelligently deliver highly personalized services for maritime organizations today and in the 5G future.

Intel is driving network transformation and enabling Edge compute that's needed to bring 5G to life. Intel is transforming purpose-built networks to become more agile, flexible, and scalable with Software Defined Networking (SDN) and Network Function Virtualization (NFV)—setting the stage for 5G.

INTEL 5G
ARCHITECTURE, FPGAS, SOFTWARE, SECURITY, AI

| Smart Devices | Wireless Technology | Access Network | Core Network | Cloud |

SCALABLE & FLEXIBLE TECHNOLOGIES AND OPEN SOURCE

Intel® Processors & SoCs | Intel® FPGA | Intel® QuickAssist Technology | Intel® Ethernet Adapter | Intel® Silicon Photonics | CLOUD NATIVE COMPUTING FOUNDATION | DPDK | kubernetes | ONAP | OPEN DAYLIGHT | Open Source MANO

For Intel's communications service provider customers, the work is already underway as they lay the foundation for 5G and transform their communications infrastructure to SDN. This enables more seamlessly connected, powerful, and intelligent 5G-ready networks in comparison to previous networks that were hardware-based. Leading service providers around the globe have made incredible progress in advancing SDN and NFV with solutions across the core network.

The **Open Network Edge Services Software (OpenNESS)** Toolkit offers cloud and IoT developers an easy-to-use toolkit to develop and deploy applications at the network Edge or on-premises Edge locations. By abstracting out complex networking technology, OpenNESS exposes standards-based APIs from 3GPP and ETSI Multi-access Edge Computing (MEC) industry group to application developers. Using this software toolkit, applications can steer data traffic intended for the Edge at 5G latencies.
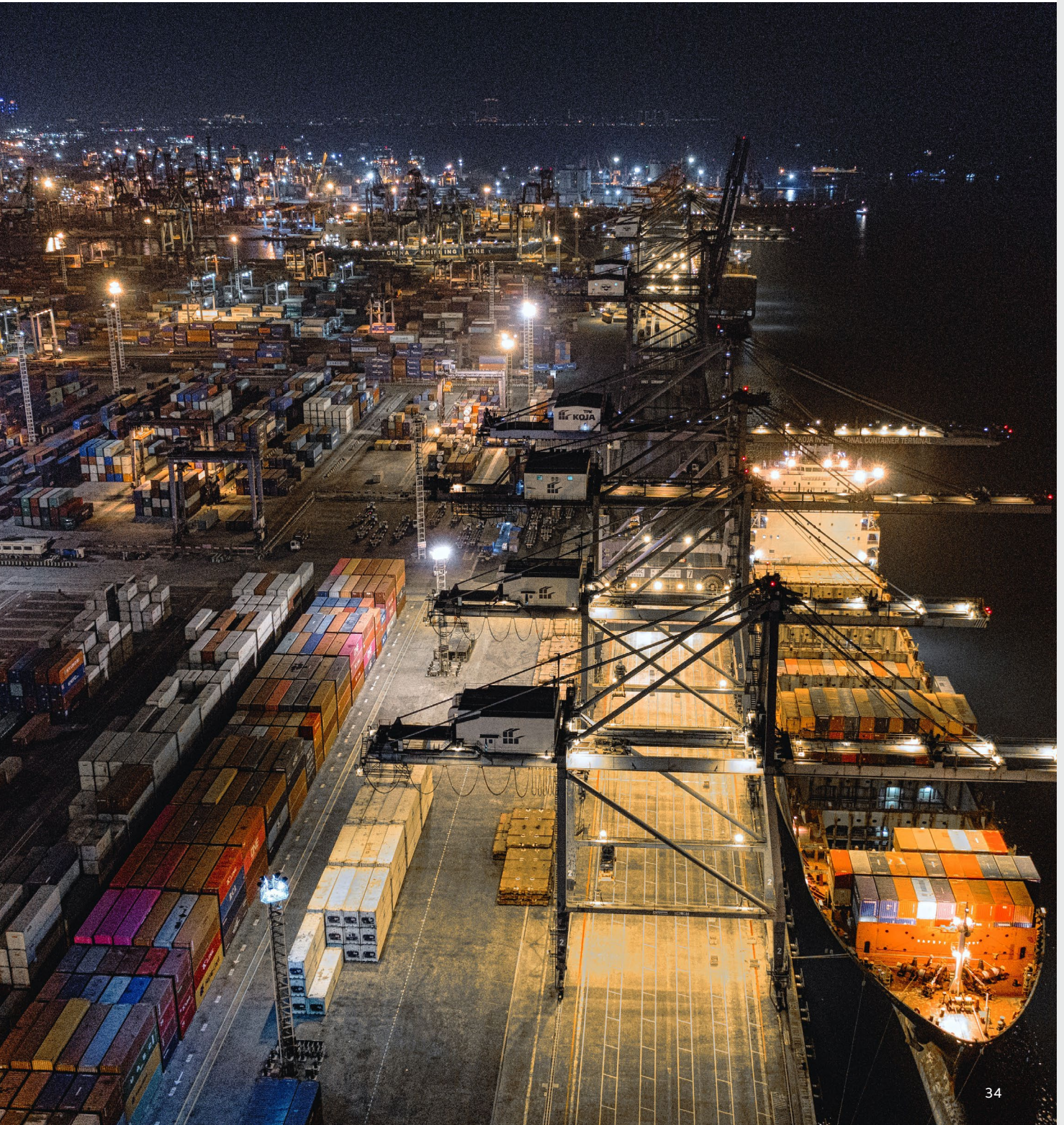
INTEL AND DELL TECHNOLOGIES PARTNER SOLUTIONS

FURUNO HERMACE REMOTE MONITORING AND TROUBLESHOOTING PLATFORM

In the rise of the IoT era, maritime organizations are struggling to manage large amounts of data, quickly and in near real time. Due to high workload of ship crews, errors generated by bridge equipment can be missed or misdiagnosed at early stage, subsequently leading to a complete failure in either a remote location or time-sensitive situation. Faults may only be picked up during a survey or port state inspection, which could then lead to the vessel being detained for corrections. Ultimately this leads to unnecessary additional costs that could have been avoided in a more convenient port. Providing a swift diagnosis and clarifying the exact nature of the failure is key to ensuring the integrity, security, and availability of ship systems.

Furuno equipment can be interconnected to create a Furuno Sensor Network integrated with HermAce. As a centrally integrated connection, HermAce can monitor critical system data pertaining to the vessel's equipment, which is collected through a smart device positioned onboard the vessel and transferred via the ships satellite communication system to secure data centers. With reliable ship to shore communications and limited effects on bandwidth availability, the HermAce system will deliver consistent, near real-time system monitoring, coupled with a user-friendly customer web portal, that enables the shipping company to access the ship's data live.

For more information: Video • Website

NAVARINO INFINITY CUBE
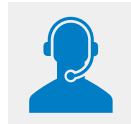
Crew members aboard ocean-going vessels deal with communication, operations, and logistical challenges daily. Due to isolation, they must work with the technology they have onboard. If communication breaks down with operators on shore, this puts the crew in increased danger. The Infinity Cube, powered by **Dell EMC PowerEdge** server technology, is an on-board, highly available, virtualized, cloud infrastructure that improves connectivity from ship to shore and allows for easy adoption of shore-side IT. It improves operations and enhances safety, giving the crew reliable communications while at sea.

Key capabilities:

- **Virtualization and consolidation of the IT infrastructure:** The environment allows for the installation of any specialized critical applications, while removing different and sometimes outdated computers improves overall security and cost efficiency, reducing maintenance and costs.

- **Centralized management and administration:** Gain access to all important IT and communication functions through one common management console resulting in an increase in productivity and operational efficiency of all crew members aboard and a reduction in overall operation costs.

- **Hardware scalability:** Configure the system to meet the most demanding requirements while being ready to incorporate new functionality in the future.

For more information: Website

IOT.NXT ASSET TRACKING

As industries are driven to do more with less, asset tracking is more important than ever. Monitoring maintenance, performance, and location are all top of mind for ships and ports organizations who manage assets. From improved inventory accuracy to compliance with industry mandates, the IoT.next Asset Tracking solution can be overlaid onto existing infrastructure to minimize disruptions. Once implemented, agility and fast reactivity to weather, market prices, and even local traffic conditions begin to increase productivity. The IoT.nxt Asset Tracking solution also helps ships and ports tie asset data in with fuel levels (both in the fleet and stored), production levels, supply, and demand.

Key capabilities:

- **Maintenance:** Near real-time tracking helps ensure that maintenance of fixed and mobile assets is scheduled, resulting in minimal downtime, and, where possible, avoiding major breakdowns and productivity stoppages as a result of component failure.

- **Near real-time visibility:** Enables the deployment of fleets and service teams automatically and remotely, optimizing supply chains and preventing production downtime by monitoring. Reduces loss of valuable and returnable assets as well as misuse by creating complete visibility.

- **Organizational overview:** Complete visibility of all assets, delivery schedules and progress, and digital evidence bags help track and trace products from factory floor to final delivery and monitor system performance across the business.

- **Asset tracking and monitoring:** Accurately track assets along the entire supply chain, particularly in the case of unanticipated breakdown or loss, provide preventative maintenance and damage monitoring, optimize process efficiency and track people during emergency drills and evacuations.

For more information: [Website](#)
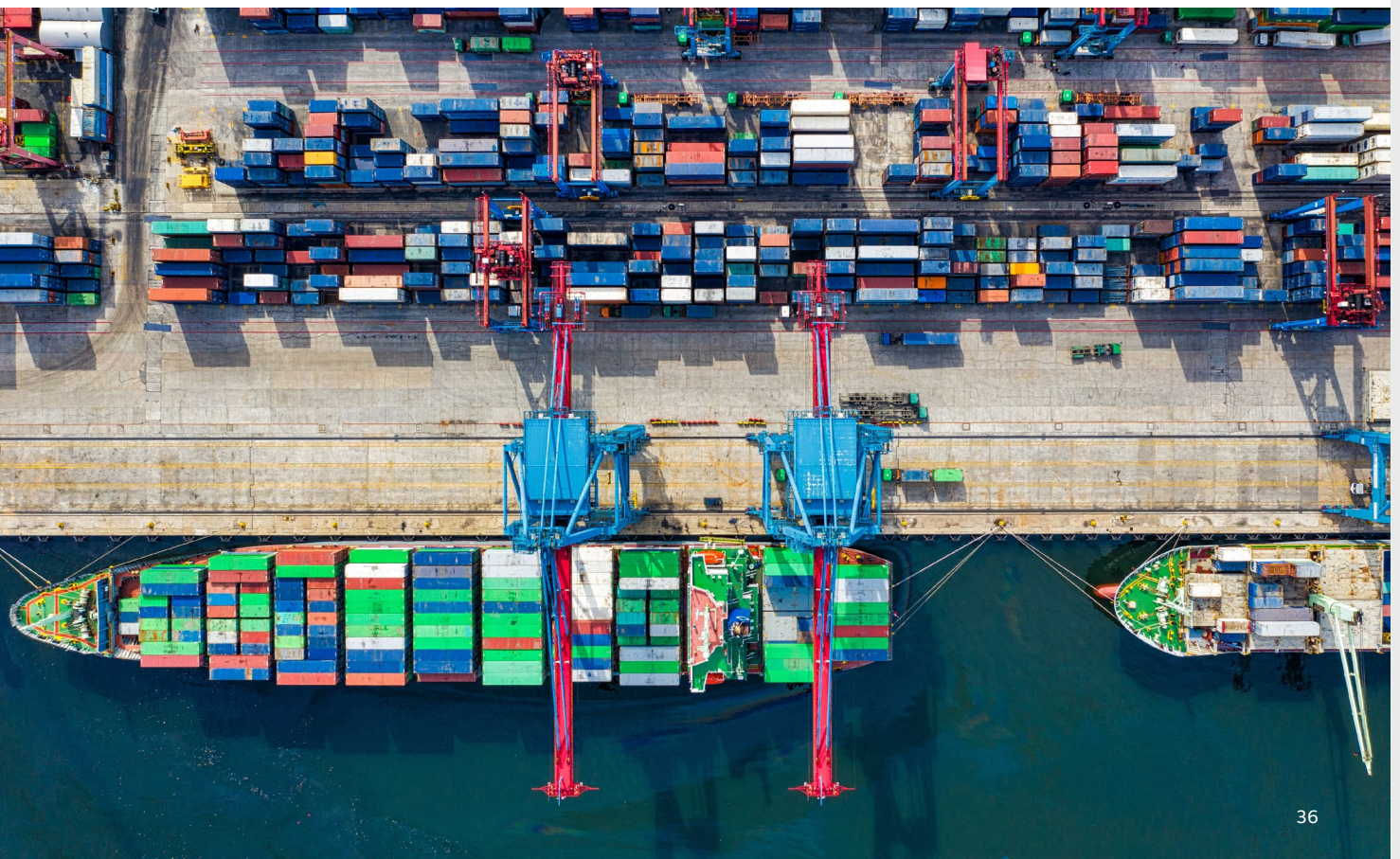
GETTING STARTED

Catching the wave of innovation in the maritime industry requires assembling a crew of like-minded leaders to take the journey together. Leading management teams plan their intelligent maritime initiatives across three action areas to:

1. Transform data into new insights in how their operation works with intelligence from Edge to cloud.

2. Leverage proven Intelligent Maritime solutions to support stakeholder goals.

3. Consolidate systems at the Edge for greater efficiency and value.

Initially, leaders should examine which services may have the most impactful outcomes. Stakeholder identification, participation, and clear priorities are essential foundation points for building your plan. By drawing upon experience working with many maritime stakeholders and government officials worldwide, Intel and Dell Technologies are bringing together the right solutions that maritime leaders can use to create and implement achievable plans.

Six steps to embark on your Intelligent Maritime journey

IDENTIFY STAKEHOLDERS

ASSESS CURRENT STATE

CREATE A SHARED VISION

BUILD BLUEPRINTS

MARK MILESTONES

SELECT KPIS

1. Identify Stakeholders

Within the complex structure of the maritime ecosystem, identify the major stakeholders in any digital transformation project. Depending on the project, this can include, government representatives and members of the stakeholder management teams.

2. Assess Current State

Determine the current status of the port and cargo vessels and discuss key performance indicators you will use to quantify success. What works? What needs work? How can you improve the satisfaction, security, safety, and success for all stakeholders?

3. Create a Shared Vision

Establish your ultimate outcomes, expressed in terms of stakeholder benefits. The vision should not be expressed solely as technical achievements but also as experiential improvements that technology can make possible. It is essential to build that vision with stakeholder involvement to achieve better and more diverse suggestions, consensus, and commitment.

4. Build Blueprints

Develop a priority list and "blueprints" for the most important projects in your technical modernization plan. Possibilities include master plans for:

- Better utilization of vessel or port space and/or the addition of new space

- Modernization of the current technical infrastructure (communications and computing resources)

- Data collection

- Improvements to all interacting maritime systems .

5. Mark Milestones

Identify waypoints at which you measure progress, share lessons learned, discuss course corrections, and strengthen stakeholder commitment to your shared vision.

6. Select KPIs

Decide on key performance indicators that quantify success and align with your vision.

Exploring Financing and Partnerships

Implementing a comprehensive vision for intelligent maritime in your organization will require committed funding and careful planning. As recent examples around the world show, the innovations come not only from new technologies and processes, but also from a variety of funding and financing sources. Exploring multiple options such as regional economic development; local and federal agency funding for transportation, public safety, environment; and private developer and industry partnerships can reveal new sources of investment. Developing financing partnerships which also embrace industry knowledge, best practices, plus key solutions and technologies, provides insight from planning through implementation.

Defining and executing an intelligent maritime strategy is neither straightforward nor without risks— but the benefits can be significant. At Intel and Dell Technologies, we believe that successful maritime innovation requires certain key components: the right level of stakeholder participation, clear priorities, and methodical planning of technology infrastructure.

This is only a starting point for a transformative maritime journey. We believe stakeholders can achieve success by establishing clear priorities, encouraging active stakeholder participation, and ensuring methodical technology infrastructure planning while enabling the right policy and governance. **With our Edge to Core to Cloud solutions and strong partner ecosystem, Intel and Dell Technologies can help bring your vision to life.**

THINK BIG
Chart your future with intelligent maritime

START SMALL
Begin with projects and opportunities

MOVE FAST
Learn, adjust, iterate

→ Visit Intelligent Maritime Solutions from Dell Technologies

RESOURCES

Bring value to the maritime industry from Edge to Core to Cloud, and ship to shore.

For more information, visit

⇥ **delltechnologies.com/edge**

⇥ **delltechnologies.com/oem**

⇥ **delltechnologies.com/oem/marine**

⇥ **edgeecosystem.delltechnologies.com**

Dell Technologies Solution Centers

Dell Technologies Solution Centers are a global network of state-of-the-art technical labs constructed just for customers. Launched in 2011, they are places where customers can explore and test solutions, enabling them to select the best technologies that will truly work for them and meet their business objectives. Solution Centers are built and run on Dell Technologies platforms powered by Intel, representing a "living lab" to showcase real-world deployment of Dell Technologies solutions and capabilities. Dedicated experts work with customers in the centers to share best practices and knowledge. This combination allows customers to "try before they buy," proving out and optimizing their architectures on Dell Technologies infrastructure before committing to a production environment or services contract.

Solution Centers also provide customers with technical briefings, architectural design sessions and independent software vendor certification. With 12 centers now open globally, the most recent in Silicon Valley, Dell Technologies has connected with thousands of customers, enabling them to get hands-on with Dell Technologies solutions.

Dell Technologies Executive Briefing Program (and Centers)

Strategize, plan and learn with the Dell Technologies Executive Briefing Program. The Executive Briefing is a collaborative experience, designed for engaging, consultative conversations that help bring your visions to reality.

Dell Technologies Ignition Labs

Dell Technologies Ignition Labs have a dedicated space for the Intel IoT Lab Ignition Labs where customers can engage in a number of activities including a briefing, a workshop, or running fully supported proofs-of-concept using their data.

Dell Technologies Services, Payment Solutions

Dell Technologies Financial Services helps you acquire the essential hardware, software and services you need to run your maritime organization. Our portfolio of industry-leading payment solutions includes traditional leasing and financing options, as well as advanced flexible consumption products. Maximize your IT budget and get the technology you need today.